THE ENVIRONMENTAL EFFECTS OF URBAN INTENSIFICATION

March 1991

Prepared for: *Municipal Planning Policy Branch*
Ministry of Municipal Affairs

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March 1991

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SUMMARY

URBAN SPRAWL is emerging as a key environmental issue in Ontario. Concerns include the consumption of agricultural land and natural areas for urban uses, as well as damage to habitat, biological diversity, and ecosystem processes. Low-density urban sprawl also reinforces the dominant role of the automobile in our society, and frustrates alternatives such as public transit, cycling, and walking. Automobiles are associated with the over-consumption of depleting non-renewable energy reserves and serious air quality problems ranging from smog to carbon dioxide emissions.

Land-use intensification—higher densities achieved through infilling, redevelopment, conversions, and more compact new development—provides a wide variety of environmental protection benefits. For example, more compact communities allow the wider use of non-automobile transportation forms. The result is likely to be a reduced total air pollution load (including atmospheric CO_2) reduced land consumption and a significant reduction in the pressure on non-renewable energy resources. In all, the report identifies sixteen environmental opportunities associated with intensification. For instance, (1) agricultural land is more easily protected; (2) higher density dwelling units themselves are typically more energy and materials efficient in several ways; (3) environmentally sensitive areas can be more easily protected when cities are more compact; (4) overall water demands per capita may diminish; and (5) infrastructure will be more efficiently used. Nine environmental risks associated with intensification are also identified. For example, there are potential problems regarding storm-water run-off, localized air quality within the urban core, congestion and noise, and some possible micro-climatic effects. However, the report concludes that many of these risks are avoidable and, overall, are heavily outweighed by the benefits. The net effects of intensification are likely to be strongly positive in environmental terms.

Nonetheless, land-use intensification *per se* is not a panacea. The benefits are not automatic and, poorly implemented, intensification could create new problems. Intensification should be seen more as an environmental opportunity than as, in itself, a solution. To ensure the greatest net gain, intensification must be implemented within the context of various environmental and other policies designed to maximize the opportunities and to minimize the potential costs. The report identifies many possibilities regarding how intensification might be most effectively achieved.

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1. URBANIZATION IN HISTORIC PERSPECTIVE

The urbanization of southern Ontario

THE extent and form of urban development has for some time been overshadowed by such high profile environmental issues as toxic waste, nuclear power, and water quality. However, in Ontario as elsewhere in North America, urbanization is emerging as an important focus of concern and advocacy.

The historical trends are alarming. In the Windsor-Québec City Axis, which includes the urbanized areas of southern Ontario, the share of land defined as urban more than tripled between 1921 and 1981, from 4.2 per cent to 15.1 per cent (Yeates, 1985, pp. 44, 78). This trend is expected to continue. By 2001, the urban share of land is projected to grow to 18.9 per cent. (See maps, Appendix 1, Figure 5.)

In Ontario, Yeates anticipates that "urban growth between Kitchener-Waterloo and along Lake Ontario as far east as Port Hope will be quite dramatic. Urban development northwards to Barrie and Orillia will yield not only a new continuous urban corridor, but an extensive area of suburban and 'countrified' ex-urban developments" (p. 77). Yeates describes the Windsor-Québec City Axis as a well defined macro-urban region linked by transportation networks, economic ties, and other common characteristics (p. 3). Although the region is not fully urbanized, the rural land between population centres—the "city's countryside"—is defined by its relationship to the metropolis and is under continuous, often intense development pressure.

In addition to *direct* pressure from contiguous urban expansion, rural land is subject to *indirect* pressure from land-uses such as rural subdivisions, individual residential severances, autowreckers, waste dumps, highways, airports, race tracks, and sod farms (Yeates, p. 79). Less visible but even more pervasive in its effects is the indirect impact on land prices and tenure as exurbanites and speculators buy up rural land. Yeates estimates the indirect impact of urbanization at a ratio of five to one. That is, for every hectare of rural land in direct urban use, five hectares are indirectly brought into urban use (Yeates, p. 80).

Impacts of urban sprawl

The extensive use of land for urban and urban-related uses has a number of serious environmental impacts (and related social and economic impacts), some of them related to the conversion of land from rural to urban, others related to the *kind* of urban development that predominates. They include the loss of agricultural land, the destruction of natural areas, deteriorating water quality, and the energy use and pollution attributed to increased automobile travel. These effects will be examined in greater detail in Chapter 3.

Of necessity, cities evolve only very slowly. We can change the lighting fixtures in a given building in a matter of days. We could alter the dominant sources of electric light across the province in a few years. The bulk of the province's fleet of automobiles will turn over within a decade. Appliances as well change over a comparable period of time. But the building stock turns over at a rate of only 1 per cent a year (Owens, 1987, p. 183), and the predominant pattern and organization of our cities changes only in a time frame of several decades or more. For this reason we should not delay beginning the process of urban change.

An ideal suburb: Welwyn Garden City, by L. de Soissons, 1919. In Benevole, Leonardo, *History of Modern Architecture*, Vol 1, MIT Press, 1985, p. 352.

2. INTENSIFICATION, URBAN FORM AND ENVIRONMENTAL PROTECTION

Rethinking environmentalism, rethinking the city

IN THE 1970s environmentalists were negative about cities—they viewed congestion and pollution with alarm. The solution was to reject the city and return to the land. Environmentalist ideals focused on pristine wilderness or on a bucolic, self-sufficient rural existence. These views were consistent with the nineteenth century conservationist origins of environmentalism (Paehlke, 1989). They were also implicitly consistent with the suburban ideal of Howard's Garden City.

However, in practice, many who sought to go back to the land did not attain self-sufficiency. They just commuted further—either *into* the city on a daily basis or *out of it* on a weekly basis. Ironically, they found themselves pushing the urban shadow further and further into the adjacent countryside.

At the same time, urban reformers struggled to limit heights and densities within the urban core. Many of the projects they opposed were ill-conceived, but the net effect of their efforts was to help push the swelling urban population ever outward.

Today, the logic of sustainable development points to a radical revision of the 1970s perspective. Both environmentalism and the city require new thinking. A more contemporary environmental perspective recognizes that the needs, objectives, and ideals of environment and economy must be reconciled. Preserving nature and developing a sustainable economy in the long-term require creativity and a reconceptualization of the urban forms of the future. Instead of simply rejecting the city in favour of the country, we need to find environmentally sustainable forms of urban development.

Part of the answer, explored in this report, is to embrace rather than fight one of the central features of cities: higher population densities. Numerous

recent reports and studies—several of which are briefly excerpted in section 5 below—commend the notion of urban intensification (higher densities) on environmental grounds.

We should be clear that in many ways this view involves a real departure from earlier environmentalist thinking. The sprawling, segmented city itself was an attempt to put industrial processes out of sight while continuing to enjoy consumer products and employment opportunities. But, ironically, an urban form that places industry and commerce out of view reinforces the very character of urban life about which environmentalists have raised doubts: energy intensity, pollution, encroachment on habitat and agriculture, and non-sustainability.

Housing which is affordable in terms of its life cycle costs must be energy- and materials-efficient—both as an individual structure and as a part of an urban form. But perhaps the key to cities which are successful in the long-term lies in planning for access by proximity rather than access by transportation. Industry must be and can be clean enough that it need not be hidden or distant. Only compact cities can avoid the levels of congestion from which urban dwellers seek refuge. The fear of increased densities is primarily a fear of increasing traffic congestion, noise, and crime. Careful planning and creative design can go a long way toward overseeing these and other concerns.

In stark terms, our cities need to become more dense and more functionally integrated if there is to be either a quality regional countryside or a quality global environment. This report is about why this is the case and about how we can begin to reconcile the environmental consequences of this new perspective. It will also briefly examine some of the potential economic and social consequences associated with intensification.

Homes, vehicles and cities: The ultimate green products

Recycled paper, cloth diapers, phosphate-free detergents—the list of "green" products seems to grow daily. And more and more consumers are informing themselves about the environmental implications of what they purchase and how they use these products. This is one of the genuinely positive trends of the 1990s.

It only makes sense that the largest decisions a consumer makes—the choice of a home and the daily choices made regarding transportation mode—are the most important in environmental terms. But these choices are constrained or encouraged by collective public choices regarding urban form and transportation planning. Perhaps the most crucial dimension of an individual's decision in this realm is the choice of home location in

relation to work and services necessary on a daily basis. This decision is significantly affected by the range of options available.

The predominant pattern of industrial location places employment opportunities at a distance from many residential options, especially the best options. Well-intentioned requirements regarding the character of industrial "parks" can virtually assure that those distances are relatively large. Residential planning in turn remains overly dependent on the detached single-family option in which homes are too often arrayed at a density and pattern that virtually precludes all non-automobile transportation options.

In Ontario in 1985 there were in total 1.8 million single-family detached homes, 918,000 apartments, and 378,000 semi-detached and row houses (Ontario. Ministry of Energy, 1986). But only rarely have attempts been made to provide family-oriented amenities, easy access to employment opportunities and services, *and* medium densities. The emerging ideal of a compact, mixed-use, human scale, urban form has barely achieved the demonstration project stage in Ontario.

What is intensification?

"Intensification" is a term applied primarily to the residential sector of cities and towns. The Canadian Urban Institute (1990) characterizes intensification as "residential development of a site at a density that is substantially higher (high enough to support public transportation) than previously used, existed or designated for that site." (See Appendix 1, Figures VI, VII, VIII, and IX.) Five categories of intensification are identified:

- Conversion - increasing the number of households within existing housing forms through renovations and additions,
- Infill - building new housing on vacant and underused land within existing residential developments,
- Redevelopment - building new housing on serviced sites whose original function has diminished,
- Adaptive re-use - changing the function of a site to residential,
- Suburban densification - changing the specifications governing subdivision developments (e.g., minimum frontages, setbacks) to allow for higher density development.

In Ontario, intensification has been a topic of discussion in government circles since the early 1980s (see Hulchanski, 1982 and Ministry of Municipal Affairs and Housing, 1983). The provincial government's Policy Statement *Land Use Planning for Housing* contains a section promoting intensification (Ministry of Housing, 1989, p. 8). However, the principal concern in these reports and in the policy statement is largely the potential for creating additional housing—particularly affordable housing—through intensifica-

tion. It is only recently that intensification has come to be valued also for its potential impact on urban form and the environment (Canadian Urban Institute, 1990, p. 4). (See also Roberts, 1975 for an interesting precedent.)

A notable example of this newer approach to intensification is the *Greater Toronto Area Urban Structure Concepts Study*, an eight-volume report exploring the impact of three alternative approaches to future urban growth in the GTA:

- spread (continuation of present low-density trends),
- central (intensification within Metro Toronto and other "mature" urbanized areas adjacent to Metro),
- nodal (compact development around decentralized nodes).

According to the study, 1500 km^2 (590 sq. miles) of the GTA is now urbanized. The three urban structure concepts differ significantly in the additional land they would consume by 2021 (IBI, 1990):

- spread: 900 km^2 (350 sq. miles),
- central: 340 km^2 (130 sq. miles),
- nodal: 590 km^2 (230 sq. miles).

The study also forecasts the relative impacts of the three options on the Oak Ridges Moraine and the Lake Ontario waterfront, agricultural capability, forest resources, and air quality and energy consumption.

Municipalities elsewhere in the province are acting on intensification. For example, the City of Ottawa Official Plan (draft, 1989) states that the city council shall minimize energy consumption by "promoting a compact pattern of urban growth; encouraging infilling, reuse and redevelopment, and encouraging, where suitable, mixed use developments to reduce travel time."

Intensification and boundary containment have also been considered in smaller cities. Oakville, Brampton, and Oshawa have retained consultants to study options for housing intensification (Canadian Urban Institute, 1990, p. 23). Research is underway regarding intensification in hamlets and rural agricultural areas (Hamilton, in preparation).

Thinking environmentally: New criteria for planning decisions

How can we be sure that intensification makes sense environmentally? There are, of course, environmental risks and costs associated with intensification, as there are with virtually any human activity. The most important risks will be identified below in section 4. There are also numerous benefits as has already been suggested and these will be detailed in section 3. On what grounds can we assess whether there are net gains? And, once

sure, how can we maximize gains and minimize risks? All of these crucial questions require that we be clear about decision criteria and priorities.

Fundamentally, there are two categories of environmental concern: resource sustainability and environmental impacts. For nearly a century (prior to 1970), with a few exceptions, resource concerns were oriented to renewable resources: principally forests, wildlife, fisheries, grass lands, recreational spaces, and soil quality. Since 1970 there has been growing concern regarding modern industrial society's dependence on non-renewable resources, especially fossil fuels and particularly oil. These concerns continue to this day: Are we extracting more of or from these resources than nature can replace? Do the processes by which we accelerate restoration create a less desirable and diverse environment in the long term?

Concern with environmental impacts has developed and even accelerated from the 1950s to the present. Air and water pollution have been at the centre of concern, but the focus on impacts has expanded to incorporate the developing sciences of ecology, toxicology, and epidemiology. The 1970s and 1980s saw rising concern with carcinogens, toxic chemicals, and hazardous wastes.

Environmental impacts, however, are not limited to pollution and its effects on flora, fauna, and human health. Also critical are concerns with animal habitat, bio-diversity, wetlands, endangered species, and ecosystem integrity. Most recently attention has shifted to regional and global impacts such as acid precipitation, damage to the ozone layer, and global warming.

Each of us in our daily activities and consumption habits contributes directly or indirectly to many of these problems. All things being equal, more people produce greater impacts. But total population is not something readily influenced by governments. Further, all things are not equal: our impact on the environment, individually and collectively, depends on many factors. For example, a poor person in a poor nation may consume one-tenth or one-hundredth the amount of a wealthy person in a wealthy nation. But, once again, affluence is not something a society would wish to constrain if there are other possibilities for achieving effective environmental protection.

There are three important options:

- First, there are abatement technologies such as precipitators, settling ponds, baghouses, and scrubbers, to capture contaminants before they enter the environment.
- Second, and better, new industrial processes can sometimes eliminate a given hazardous chemical from a given industrial process or product. Zero discharge should be the goal, but there is no magic available, nor perfection on the horizon.
- Third, products and processes *and cities* can be designed to be more efficient in their consumption of energy, material, or land. This latter approach many environmentalists now believe to be the most

promising of all. A more technical explanation of this perspective is presented in Appendix 2.

Many environmentalists have argued that energy is at the core of the environmental problems we face. Energy at the present rate of use is perhaps the least sustainable aspect of our contemporary society and economy. In addition, as Canadian environmentalist David Brooks has noted, the predominant proportion of all environmental impacts arise in the production and use of energy. The U.S. environmental economist Kenneth Boulding has argued that the solution to the environmental problems we face is to maintain our levels of wealth and comfort with a diminished level of "energy and material throughputs". The same notion is captured in the Science Council of Canada's vision of the Conserver Society in which we simply "do more with less".

Each of the factors involved (population, affluence, abatement technologies, energy per unit of output, materials per unit of output and land use per unit of output) is important. But also important is how these factors relate to each other. When more materials are used than might have been used, more energy is necessary to produce those materials. More air and water pollution attends that additional expenditure of energy as well as the additional extraction of materials itself. When an urban area is intensified, energy and materials can be saved (as we will see) in many different ways. Each savings at this end point of use results in significant reductions in environmental impacts in many different locations. Let us consider how this interaction might work in a typical case.

An historic building proximate to commerce and employment is converted to residential housing. A new foundation need not be dug. New materials for exterior walls need not be produced. Servicing (roads, sidewalks, sewers, and public transportation) already exists and again materials use is reduced. Commuting distances (by auto) are on average shorter than from housing at the urban fringe. More residents will opt for non-automobile mobility. More energy is saved.

The use of fewer materials results in additional environmental gains at the point of energy production, either in the scale of an oil sands plant yet to be built, in the amount of tailings at a uranium mine, or in the number of oil tankers plying the seas and at risk of accident. As well, the existing exterior walls of the historic building will not end up in an overburdened landfill site. Nor will more forests be cut (or steel smelted) to build the walls and floors that are re-used. Nor will the energy be required to produce and transport the materials that have been saved. But—and this is crucial—people are still comfortably and conveniently housed, they continue to go where they want, when they want, many construction and related jobs remain available, and new jobs are created in the public transportation sector. (On the employment effects of environmental issues see Paehlke, 1989.)

Finally, we need to be aware that environment and resource concerns are becoming increasingly important with time. The ores from which we extract metals are at lower grades than they once were, or at greater distances from point of use, or both. The rivers we dam here in Canada are further and further to the North (and the energy and materials needed to move the electricity greater and greater per unit of output). The trees we cut now are, on average, smaller, further apart and further away than they were a century or a decade ago. We are going to the ends of the earth to extract oil. In energy and materials terms our economy and society are less and less sustainable unless we become more and more efficient. More than that, the environmental impacts associated with our future (conventional) energy and materials options per unit of demand, on average, may tend to increase. Offshore oil, nuclear power, oil sands energy, and coal each carry greater environmental risks per unit of output than do our dominant present sources: domestic oil and natural gas.

We need to turn these concerns and risks into challenges and opportunities. The future must emphasize the elimination and abatement of environmentally hazardous products, processes, and forms and patterns of economic activities and development. As well, and possibly even more important, we need to accelerate the achievement of greater energy and materials efficiency and a reduced dependence on non-renewable resources, especially non-renewable energy resources. A sustainable development perspective places the focus squarely on this point. In this view, environment and economy are not fundamentally at odds. A future economy that is sustainable can be achieved only if we address environmental concerns of all kinds as we make our consumer choices, design our factories, plant our crops, and construct our cities. This perspective can help to establish, evaluate and integrate the advantages and disadvantages of urban intensification. It can also help in planning cities which are more compact *and* more hospitable.

"Macro" environments and "micro" environments

One way to understand the complex issues involved in the relation between urban form and the environment is to distinguish between global and regional ("macro") issues and neighborhood ("micro") issues.

A global concern like the greenhouse effect urges us to reduce carbon dioxide emissions. Regionally (in Ontario) we must better protect both natural areas and prime farmland. Relatively compact cities and mixed-use planning would help both to happen.

But neither of these "macro" environmental concerns necessarily offer answers to those urban or suburban residents who would prefer that there not be more people living on their block or in their neighborhood. They are concerned about added pressure on recreational spaces, or about the scale of their surroundings, or about noise and congestion.

These, too, are environmental concerns. They might be characterized as "micro" concerns. They pose a very important challenge to the planning and design process. As we will see, they are no less important than the "macro" concerns and they must be reconciled in new and imaginative ways. But before we consider these challenges to the planning process in terms of how to intensify, it is important to review in detail why intensification is environmentally appropriate.

3. COMPACT CITIES: CREATING ENVIRONMENTAL PROTECTION OPPORTUNITIES

THIS SECTION sets out the potential environmental advantages of urban intensification. Not every means of achieving greater densities is necessarily appropriate for many reasons. But we believe that in aggregate the argument is compelling and that ways must be found to ameliorate or avoid other concerns. We identify 15 advantages.

❒ 3.1 *Intensification creates opportunities for access by proximity. This can reduce the need for motorized transportation.*

This principle, articulated nicely in Vancouver's recent *Clouds of Change* report, is key to planning cities to become increasingly sustainable. Changes in urban form can be achieved only slowly and must be guided through the years by clear principles. Continuously enhancing access by proximity captures two central principles in one succinct phrase. Urban intensification and mixed use planning in combination achieve many things, but the most important effect environmentally is a reduced need for motorized transportation (Goldstein, Holtzclas, and Davis, 1990; Holtzclas, 1991). In sustainable development terms this is important even if the reduction in distances actually travelled on a daily basis is slow to come. Sustainable development looks to the long-term future. Gradually, more and more people can achieve a reduced dependence on daily, long-distance travel by automobile at least cost through reducing the need for travel itself. *Present* trends, without a strong commitment to intensification, run in the opposite direction.

Automobiles are wondrously convenient devices. In cities they offer the greatest service to each of their owners—if and when owners do not use them on all possible occasions for all possible purposes. Traffic congestion produces massive environmental impacts and, simultaneously, all but eliminates the principle advantage of automobile transportation: personal convenience. Pollution emissions and fuel use in congested traffic are higher both per kilometre and per minute than in freely flowing traffic at modest speeds. Some people will always need automobiles, others will continue to prefer them. The challenge to planners is to help to create urban settings of varying sizes where some people choose lives with minimal use of automobiles and most people can achieve most of their important daily objectives without them.

❒ 3.2 *Higher densities enable more viable, convenient, and cost-effective public transportation.*

A widely cited Australian study on transportation and density in 32 world cities shows conclusively the direct relationship between density, viability of public transit systems, and automotive fuel usage. Metro Toronto's population density is about twice that of Chicago and its per capita gasoline use is two-thirds of the level in Chicago. Chicago, in turn, is twice as dense as Houston and this results in 76 per cent as against 94 per cent commuting to work by auto. European population densities are typically one-third higher than Toronto and public transportation, cycling, and walking are all more frequently used. (Newman and Kenworthy, 1989. Selected data adapted from this study can be found in Appendix 1 as Tables I-III, and Figure J.) Private car travel per capita is less than one-half of the levels of Metro Toronto. One very recent California study concluded that "a doubling in density of residential development reduces vehicle miles travelled per household by 20 per cent to 30 per cent" (p. 7), and that "areas that are built to high density will not function effectively without transit service, and will provide an excellent market for establishment of such service. Conversely, the presence of high quality transit facilities ... will provide a market incentive for increases in density, for both residential and commercial establishments, and will naturally provide higher densities as long as zoning does not prevent this result" (Goldstein et al., 1990, p. 9).

Transit currently has a 24 per cent share in total peak period round trips in the Greater Toronto Area. This is considerably higher than in most smaller urban centres in Ontario. Shifting just 5 per cent of the remaining peak period car trips to transit in the GTA would result in a savings of more than 150,000 trips and more than 1,570,000 vehicle kilometres per working day. Emissions on each workday would be reduced by more than 3.6 tonnes of volatile organic compounds (VOCs), 3.1 tonnes of nitrogen oxides (NO_x)

and 4,226 tonnes of CO_2. On a yearly basis, assuming 250 working days, this 5 per cent peak period shift would eliminate more than 900 tonnes of VOCs, 775 tonnes of NO_x, and one million tonnes of CO_2 (Canadian Urban Transit Association, 1990). The energy savings associated with various alternative means of transportation are presented in Appendix 1, Table III.

One possible limitation on access by proximity is the need to concentrate employment opportunities within the central business district or at a small number of sub-centres ("nodes") well-served by public transit. As one important recent study put it: "The market share of transit for American cities can be correlated with the concentration of jobs in the central business district, the area that can be most easily served by mass transit" (Goldstein, Holtzclaw, and Davis, p. 12). This is not, of course, an argument against also locating denser housing options within or near the central business district. In the end Goldstein, et al., take the same position as Newman and Kenworthy (1989), saying that "communities with balance between jobs and housing will only reduce transportation demand if they are located within already built-up areas that are well-served by public transportation." Thus the key variable here is not a single business district, but a pattern of concentration and mixing that will support transit use.

❒ 3.3 *In a compact city, where many activities are proximate, planning for substantially enhanced cycling and walking opportunities is possible.*

Walking and cycling should be understood not only as viable transportation options but as the very best transportation options. In fact, even with only very minimal support, cycling has the potential to be Ontario's fastest growing transportation mode. So much more could be done to make the automobile one of a diverse set of desirable options, with daily decisions depending on varying circumstances. In general it should be anticipated that more compact cities will create the potential for more cycling and walking. The safety, comfort, and convenience of these options should be improved in every way possible as and when intensification proceeds.

❒ 3.4 *In a more compact city, the need for and cost of transportation-based services such as school buses, postal services, deliveries, and waste collection will be reduced.*

The savings here would in some cases be modest because the number of trips would not decline significantly. Nonetheless shorter distances should reduce fuel use and correspondingly, air quality impacts especially as

regards the intra-city movement of goods generally. As well, at even modest density increases, school busing can be eliminated at the elementary level and significantly reduced at more advanced levels. There is also the potential for important gains in the compact city in relation to waste disposal as well as waste collection. These latter matters will be discussed more extensively under point 3.8 below. It is also reasonable to assume that motor vehicle accidents, including accidents involving hazardous wastes, are a function of distances travelled.

❒ 3.5 *The smaller interior spaces typical of compact urban areas are more energy- and materials-efficient.*

Given that urban core land prices are relatively higher than urban fringe land prices, the average size of interior spaces will be smaller. This in turn has several positive environmental effects. Smaller spaces can be heated, cooled and lit with less energy per residential (or commercial) unit. Smaller residential spaces are increasingly appropriate as Canadian society is aging and family size continues to decline. Singles, single-parent families and "empty nest" couples are rapidly becoming the new majority (City of Toronto, 1989, p. 34; Rybczynski, 1991, p. 67). As well, a wide variety of energy efficiency options in building design and equipment are now available for multiple dwelling units. Finally, smaller interiors compel residents to be more selective in the number and size of their durable goods and appliances they acquire.

❒ 3.6 *At any given size, multiple dwelling units are more energy and materials efficient per unit than are detached single family dwellings.*

By definition, a multiple dwelling unit involves shared walls, roof, and foundation. There are thus significant savings in materials use. More important environmentally, energy use for a given amount of enclosed space is reduced. The energy needed for space (and water) heating and cooling—uses that account for roughly half of all primary energy demand—is a function of exterior wall and roof exposure per unit of floor space. Row houses involve a reduction of exterior wall space by up to 50 per cent. Larger, multi-story buildings will obtain even greater reductions in the proportion of exterior to interior walls, and neither floors nor ceilings are exit points for heat. A British study in the mid-1970s found that heat energy is more than 20 per cent more efficient in semi-detached houses and nearly 30 per cent more efficient in row houses than in comparably insulated single family

dwellings. A mid-floor apartment requires about one-third the heat energy of a detached house of equivalent size (Owens, 1986, pp. 41-42).

Very significant additional savings can be obtained if heating is produced on a neighborhood basis. This is a common practice in Denmark, where 40 per cent of residential and commercial heat is produced by district heating, and in Sweden where the corresponding figure is 25 per cent (Owens, 1986, pp. 51-59). District heating is most efficiently achieved at relatively high residential density and most economically developed at the time of initial development. Cogeneration of heat and electricity is possible and achieves additional increments of overall fuel use efficiency.

❒ 3.7 *More compact cities reduce the energy and materials used for infrastructure such as roads, sidewalks, sewers, water mains, telephone and cable lines, and energy utility conduits.*

The use of materials for hard services varies in relation to the number of dwelling units per acre. Very significant savings can be achieved with only modest increases in density if structures are clustered. As well, as Witold Rybczynski, (1991), one of the designers of the Grow Home, points out, "A modest one-story tract house typically needs a sixty-foot-wide lot—that is, each house usually requires sixty feet of roadway, sewer and water line, and storm sewer. A narrower, two-story cottage can be built on a forty-foot-wide lot, immediately reducing these costs by a third. A semi-detached house requires even less frontage—thirty feet ... Row houses, which can be built on twenty-foot-wide lots, have a more dramatic impact on land cost and density infrastructure cost is reduced by two thirds" (p. 77). The amounts of materials saved here are considerable and the impacts associated with extraction and production are in several cases significant. Asphalt, cement, gravel and (PVC) pipe are all industries with important environmental impacts per unit of production. As well, the high volume of material involved means that there is a significant expenditure of energy associated with the delivery of these materials to construction sites. When increased densities are achieved through infilling, existing hard services can often be utilized. When sufficient capacity has been built-in, materials and construction energy savings will be highly significant. One study of higher density residential subdivisions found that it is possible to save more than 40 per cent of "capital energy" (energy in hard services) over conventional design (Ontario Ministry of Municipal Affairs and Housing, 1982). This savings is equal to almost one year of space heating demand for the subdivision.

❒ 3.8 *Enhanced recycling, re-use, repair and waste disposal opportunities are inherent within the process of urban intensification.*

Thus far it has frequently been easier to establish recycling collections in single-family residential neighborhoods than within multiple dwelling units. The principle reason for this is that internal collection systems and storage spaces are inappropriate and/or inadequate. Intensification in the form of infilling or redevelopment would mean that recycling, and indeed all forms of residential waste management, could be built-in, both within each unit and within each building as a whole. Compact cities also have other advantages. In large cities, large populations produce volumes of recycled materials which can support processing plants which utilize the recycling-based materials stream. These facilities will be proximate to *both* raw materials and large markets—a unique business opportunity. But even in medium or small, but compact, centres, materials collection is aided by diminished distances. So too are re-use and repair which require individual delivery and service only a small proportion of the population at any given time. Finally, it is in large measure urban sprawl which has driven up the cost of landfill disposal options. Some use of landfill disposal is inevitable. The nearer to population centres sites are available, the lower the environmental and dollar cost of transporting wastes. (Long-distance hauling is highly energy intensive.)

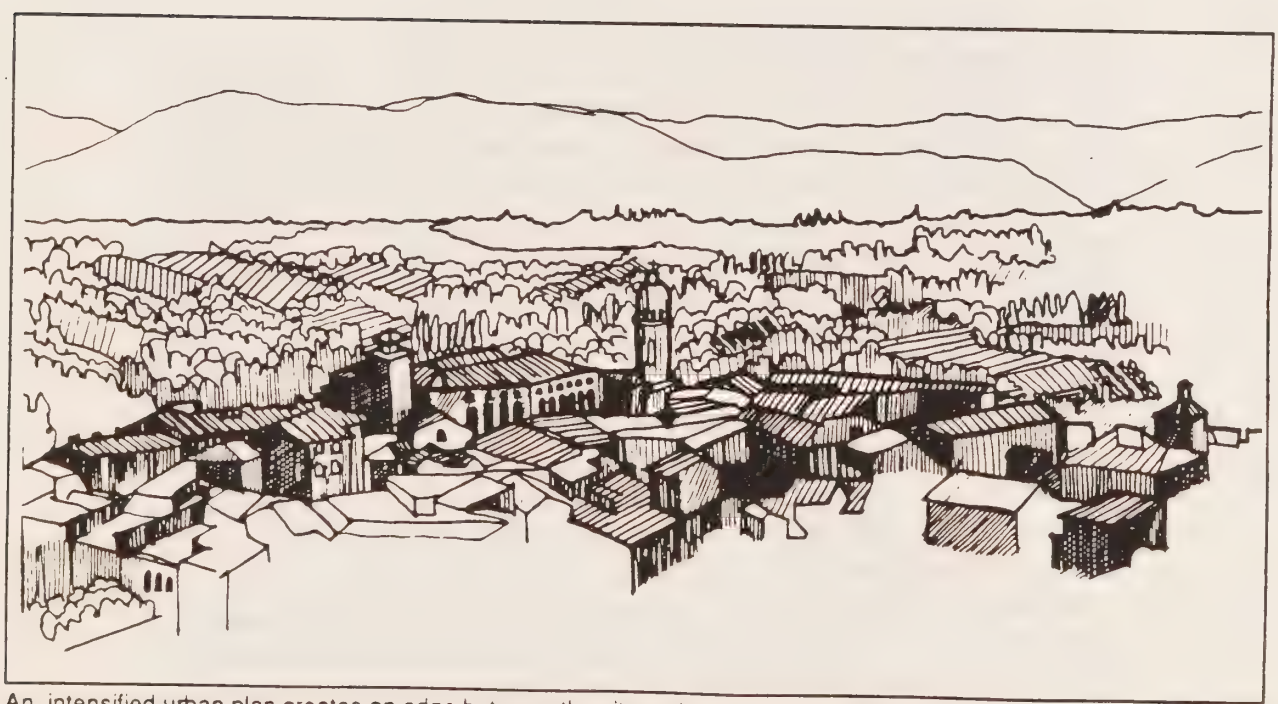
❒ 3.9 *The protection of agricultural land at the urban fringe is easier when urban land use is intensified.*

In many cases, existing cities grew up in or near areas of high quality agricultural land. Thus expansion at the urban fringe is at the expense of quality agricultural land. Agricultural land is sometimes developed first as it is relatively flat and dry and adjacent to transportation corridors. Since 1966, Environment Canada has monitored land use changes in 70 Canadian cities with populations of more than 25,000. It reports that "During those 20 years, 301,440 hectares of rural land—an area three times the size of the Toronto built-up area—were converted to urban and urban-related uses." About 58 per cent of the converted land "had high capability for agricultural production." Ontario converted more rural land than any other province, a total of more than 105,000 hectares, during this period. Nearly four-fifths was prime agricultural land. (Environment Canada, 1989, p. 9. These results are presented in more detail as Figure II in Appendix 1.) The importance of this data is reinforced in the realization that less than 10 per cent of Canadian land is suitable for agriculture, let alone of high quality in these terms. It

should be stressed that the rate of land conversion per unit of population growth was dramatically lower in larger cities, particularly cities of more than 250,000 people. (See Appendix 1, Table IV.)

❒ 3.10 ***When food production is proximate to urban cores, the food system as a whole can be more energy- and materials-efficient.***

This proposition is on one level a truism: the nearer to population centres that food is produced, the less the energy is needed to deliver it to market. What is less obvious is the fact that the overwhelming proportion of energy used within the food system as a whole is used beyond the farm gate. Indeed, on-farm energy use accounts for only a very small proportion of the energy utilized in the production, processing, distribution, and preparation of food. Keeping the distances from production to consumption relatively short can save energy for delivery as well as allow for some reduction in processing and in protective packaging materials.



An intensified urban plan creates an edge between the city and the countryside. Sienna, Italy.

❒ 3.11 ***The protection of forested areas, wetlands, access to aggregates and other resources, wildlife habitat, and significant landscape features at the urban fringe is aided by urban intensification.***

Again this proposition is largely transparent: a given increment of urban population can either be dispersed to the fringe, accommodated within the core (or several nodal points), or some combination of the two. By concentrating development, intensification can help to protect these sensitive areas and features wherever they occur—within urbanized areas, at the fringe and beyond.

Green belts and urban intensification must be seen as interdependent initiatives. Without a conscious effort at intensification, sprawl is inevitable, even with green belts in place. Without attractive higher density options, development may simply leapfrog the green belt and commuters will make their way through it by whatever means are available. Great care must thus be taken in terms of both price and quality to make more central and higher density lifestyles more appealing than the more distant options.

❒ 3.12 ***Declining urban core populations do not efficiently and effectively utilize existing facilities and services. Intensification means that those services need not be replicated elsewhere.***

The population densities of the urban cores of many North American cities have declined continuously since the Second World War as a result of out-migration to suburbs, smaller household size, low-density gentrification, redevelopment to non-residential uses, and abandonments. In Houston this has been the result of a total absence of planning—a weekday-only office tower core is surrounded by freeways, decay, and abandoned industrial and residential structures. While the city core populations of Toronto and Montreal have declined slightly, some U.S. cities have witnessed a sharper decline (Metropolitan Toronto, 1990). In some cases, residential populations are under pressure from other higher revenue options (commerce, office towers) or gentrification which can also result in declining residential densities (Metropolitan Toronto, 1989b). One environmental cost of this shift is that facilities such as schools, restaurants, libraries, and many others are underutilized, sometimes in the extreme. Yet these services must all be re-established and maintained at the urban fringe. Energy and materials are, again, wasted. As well, there are frequently associated economic and social problems within the core. Restaurants and stores have a difficult time making ends meet on lunch trade alone. Empty streets and

empty buildings are an invitation to crime and other forms of social disorder. Residential intensification within the urban core can help to revitalize the core.

❒ 3.13 ***To the extent that access by proximity and public transit utilization are achieved, some urban core and suburban lands devoted to automobiles can be freed for other uses.***

Here is the potential for a significant long-term social and environmental bonus. When we change our urban areas away from excessive dependence on automobiles, lands can be freed for use as housing, urban core mini-parks, community gardens, or courtyards. Selected streets could be narrowed (or on-street parking eliminated) to allow bicycle routes, tree plantings, or sidewalk cafés. For example, redevelopment of the harbour area in Boston, which is well served by transit, has created walkways and outdoor cafés on a small amount of land formerly devoted to the automobile. Such examples are rare, but given that the automobile claims up to from 1/3 to 2/3 of urban land, the potential inherent in shifting even a modest proportion is exciting.

❒ 3.14 ***Regional and global air quality will be significantly enhanced through the creation of compact, mixed-use cities.***

Automobiles are responsible for over 40 per cent of all air pollution (Brown and Jacobson, 1987, p. 40). In a low-density city such as Los Angeles the figure is as high as 80 per cent. Air quality is determined by total miles driven much more than it is determined by total population. Environment Canada has asserted that motor vehicles are the largest single source of air pollution in Canada. Also significant in terms of local air quality, of course, are climatological factors largely unaffected by density. But increasingly the principal air quality concerns are regional and global rather than local, and these impacts are best reduced by reducing automobile use. Additional data on auto emissions and air pollution can be found in Appendix 1, Table V.

❒ 3.15 ***More compact urban settings can be designed to reduce water demand, especially at the seasonal peak.***

In Peterborough, for example, peak daily water demand in the summer is substantially more than the annual daily average. Nearly all of this difference is attributable to lawn-watering in residential areas. In July, 1989 (a hot, dry summer) this demand was twice the annual level, in 1990 it was 60 per cent more. More compact cities have less lawn area per capita and thereby a lower demand for water at the seasonal peak. In addition, renovation and re-development can incorporate efficient residential water-use equipment (low-flow showerheads, etc.). Stormwater can be retained on-site for watering, and leaking, older water mains can be replaced at the time re-development takes place.

❒ 3.16 ***In smaller communities intensification can increase the feasibility of public water and sewer facilities.***

In rural areas, development sometimes tends to stretch itself out along the better quality paved roads. Housing may be added primarily on single-property severances. In this context both water and sewage treatment are private undertakings. To the extent that development can be concentrated within defined smaller communities, there might more easily be shared public water and sewer facilities. This could result in water quality improvements and shared costs.

4. URBAN INTENSIFICATION: RISKS AND REMEDIES

THIS SECTION sets out the potential environmental disadvantages of urban intensification. On balance we are convinced that careful intensification has strong net environmental advantages. Many of the disadvantages are avoidable risks. A considerable part of each of these risks can be mitigated by creative, human-scale design. But we cannot minimize risks unless we first identify them; we cannot plan carefully if we assume that any attempt at intensification is the best that we can do.

❒ 4.1 *Increased storm water run-off could result from increased urban intensification. The quality of that run-off may be adversely affected as well.*

Trees, bush, ground covers, and lawns absorb moisture and reduce run-off. Soils contain and allow for the filtering and transformation of some pollutants. When buildings, roads, and paved parking spaces cover a higher proportion of the land, storm water run-off will increase. When more people, vehicles, and pets occupy the same land area, the load of some pollutants is increased.

However, given appropriate policies and initiatives undertaken in conjunction with intensification, there can be improvements over both the present situation or that which would result from other urban configurations to accommodate population increases. Consider, for example, the following:

- While run-off could be more concentrated within an intensified urban centre, total run-off would be less than if the same additional population were located elsewhere. This would be true if the existing urban centre were replicated in another location and particularly true if population were added at the urban fringe at densities which

assured high dependence on automobiles. Road and parking lot run-off is a significant proportion of total storm water run-off.

- Intensified urban spaces need not necessarily significantly diminish green spaces (or at least porous spaces) within the urban core. In brief, dense construction could be achieved through moderate increases in the height of buildings, increases to the number of units within a given building, or in conversions to residential or mixed purposes. In all of these cases the quantity of green space could remain constant.
- A variety of ameliorative techniques could be adopted such as on-site or neighborhood water retention ponds, semi-permeable driveway, patio, parking lot and street surfaces, rooftop plantings, and an increase in urban trees and other vegetation.
- Some existing greenspaces (such as lawns) could be transformed into more natural local retention and infiltration systems that could play an important role in managing both the quantity and quality of stormwater run-off. (See Hough, 1989).
- Perhaps most important, urban redevelopment provides the opportunity and the funds to replace and improve storm water collection and treatment in urbanized areas (IBI Group, 1990c). Costs of these improvements should be less than the cost of new services within continuing low-density expansion at the urban fringe. The greatest difficulty would likely be availability of land for siting such facilities as retention ponds within or proximate to an urban core.

❒ 4.2 *Intensification may create increased pressures for more frequent wilderness and green space recreational opportunities.*

This is a concern which warrants additional study as it could result in increased energy use and new patterns of congestion. Is there a relationship between urban density and the frequency of the "need" to get away from it all? Environmentally, there is little problem with longer stays within Ontario's abundant outdoor recreational spaces, nor with somewhat more frequent use of more proximate green spaces (natural spaces maintained in the fringe or green belt). The problem is with too frequent automobile travel back and forth to distant recreational locations. The challenge is to create denser, more functionally integrated cities and towns that are *more* livable than the ones we have now.

One of the key factors in the livability of more compact urban settings is the noise level. This can be kept within comfortable bounds through building design and construction practices, public education, motor vehicle noise controls, and general ordinances. As well, some urban discomforts can be mitigated and ameliorated through intensification. For example, a

pleasant 10 or 15 minute walk home along pleasant city streets is far, far less stressful than an equivalent or greater time in stop and go "freeway" traffic. As *The GTA: Concepts for the Future* puts it: "There is little time left in the working day of a commuting household to enjoy the amenities of low density suburban life" (Metropolitan Toronto, 1990, p. 61). A less automobile oriented city can be both less noisy and more livable.

❒ 4.3 *Air quality within urban cores could be adversely affected.*

It is quite clear that total air pollution emissions (for a given population) will be reduced by urban intensification. This would include, for example, acid deposition and greenhouse gases. But even if the total emissions within a more dense city (and those caused by the city but taking place elsewhere) were reduced, concentrated pockets of low air quality could occur in any case. The challenge is to translate the tendency to *fewer* vehicle miles travelled into a *minimum* number of vehicle miles travelled. As well, in the event that local air quality did deteriorate, there are other possible remedies including, for example, increased subsidies to public transportation, improved average automobile mileage (achieved, for example, through varying vehicle registration fees or through rebates to non-owners or light users), or through more stringent regulatory controls on any or all sources of emissions. (See Boehmer-Christiansen, 1990.)

It also must be stated that it is far from certain that intensification and urban core air quality are related in any consistent manner. It is even possible that core air quality could improve significantly with intensification. There is no conclusive evidence available on this point.

❒ 4.4 *Intensified urban cores could become more congested.*

As a member of the Berkeley, California City Council stated to the authors of Vancouver's *Clouds of Change* report: "Fear of density is fear of increased automobile use" (p. 47). Indeed, much of the fear of intensification—primarily in terms of "micro" environmental effects—is in terms of increased automobile traffic and competition for parking. This is not an idle concern even if the persons living within an intensified neighborhood make fewer and shorter trips than they would have if they had located at the urban fringe. Several measures can mitigate this potential problem. Some new multiple unit buildings should include space for off-street parking, and surplus parking spaces could be leased from high rises and schools. Communal neighborhood parking lots are another alternative (Metropolitan

Toronto, 1989, p. 6). Careful planning of essential social and commercial services should significantly reduce the need for automobile use. New buildings could have laundry facilities, and nearby banking and grocery shopping. Day care and play spaces should be within walking distance, or—even better—within larger new buildings themselves. There is little evidence that an increased density of people and activities in themselves add to any sense of congestion. On the contrary, with creative design, this *can* add to the interest and excitement of a neighborhood, so long as there is a sense of safety, human scale, and comfort. These matters will be extensively treated in section 7. The concern with congestion is essentially an argument for access by proximity and the integration of intensification and public transit improvements.

❒ 4.5 ***There is some risk that residential intensification could incorporate, or even create, pressures for the displacement of industry. Thereby a reduction in the variety of proximate employment opportunities might occur in some locations.***

The Labour Council of Metropolitan Toronto and York Region recently submitted a policy resolution to the Ontario New Democratic Party on this point. There is a real concern that residential intensification will occur to a great extent within rezoned industrial land. The proposed policy includes provision for a levy on rezoned land "for purposes other than artists studio/residences and affordable housing". The (Crombie) Royal Commission on the Future of the Toronto Waterfront also heard frequently expressed concerns from long-established urban core industries that extensive proximate residential redevelopment would generate pressures to push established industries to other (more distant) locations. This issue is significant both environmentally and socially, and contains a real challenge for planners. Proximate employment opportunities cannot and should not be restricted to service employment alone. Many industrial structures are not convertible to non-industrial uses. Urban cores in particular should maximize land-use diversity as public transportation is typically at its best to and from the core. In the Toronto waterfront area in particular, many of these industries utilize proximate water and rail transportation, both highly energy efficient modes. Where some industrial lands are converted, great care should be taken to integrate new residential spaces with retained industrial uses.

❒ 4.6 *There is a risk of loss of existing buildings, including heritage structures.*

Buildings contain and embody our history and culture; they also contain and embody both materials and energy. Re-development involves considerable costs on both counts, cultural and environmental. Infilling vacant or severely underutilized spaces avoids these costs, as does renovation and re-use of heritage structures (Stokes, 1979). The planning process can guide developers toward converting to residential uses only those industrial structures which can with certainty no longer be utilized for their original purposes, and to replacing only those buildings which are structurally unsound or located on sites where very significant density increases are appropriate. The practice of replacing one solid building with another is generally inappropriate environmentally. It has been estimated that Metropolitan Toronto "could physically accommodate 3.8 million people through the re-development of currently underutilized institutional and industrial lands" (Metropolitan Toronto, 1990, p. 55). There would be a minimum of building removals within such an approach. Similar opportunities, as well as conversion, accessory apartments, adaptive re-use, and small infilling opportunities exist within most other Ontario communities.

❒ 4.7 *There is a risk of redevelopment on old industrial sites or rail lands which are contaminated with hazardous chemicals.*

Many urban sites have soil contamination problems which must be addressed, especially if land is to be re-used for residential purposes. However, contaminated soils are a risk *however* land is used. Redevelopment within urban areas should not proceed without an historic review of past land uses and the testing of soils at several levels. Nonetheless, old industrial and rail lands frequently present important opportunities. The prospect of development on inner city rail lands is highlighted by Newman and Kenworthy (1989), who call it "crucial as part of an integrated approach to lowering automobile dependence and providing a viable alternative to the car" (p. 114). If there is serious contamination, soils must be removed to a hazardous waste treatment facility. There are now, in the experimental stage, procedures for treating soils *in situ*. Should these technologies prove to be effective, both environmental and economic advantages would be gained. But even without such technologies, contaminated lands can be restored to use. The dollar costs of such actions are high, but—now that we understand the environmental and health costs of not acting—unavoidable. (See Weniger, 1990.)

❒ 4.8 *Intensification might sometimes create negative micro-climatic effects.*

In very dense urban cores, a large number of large buildings can concentrate high winds within urban "canyons". This concern rarely applies in cities of medium size and density. However, given that average wind levels in Toronto are moderate, this problem is clearly modest in relation to many of the other concerns raised above, in this and the preceding sections. Of greater concern is the risk that higher buildings will block the sunlight from other buildings or gardens. Passive solar energy is important to energy efficiency design. The City of Ottawa's Draft Official Plan (1989) has two relevant provisions on this point: it encourages proper building orientation using passive solar energy planning principles and it encourages, "where practical, access to direct sunlight during winter daylight hours for all south facing glass ..."(p.13). Policies of this sort should assure that this micro-climatic effect is kept to a minimum in any intensification process.

❒ 4.9 *There is a risk of overuse of existing services of all kinds.*

If extensive intensification is to be undertaken by a given community or within a particular neighborhood, a service impact assessment should be undertaken first regarding the impact on existing services. This would include both hard services (water, sewage, power, automobile-related services, and public transit) and social and commercial services (including schools, recreational facilities, libraries, health care, and so forth). It is important in general that new residents and old residents in a given neighborhood be given every chance to integrate easily. Services should be adapted to anticipate changing patterns of demand for services. Many of these issues will be treated in sections 7 through 10 below.

5. Recent Studies Supporting Urban Intensification on Environmental Grounds

THE number of very recent environmentally grounded proposals for urban density increases is remarkable considering the ambiguity or hostility with which many environmentalists viewed cities as recently as the 1970s. We offer here a series of very brief excerpts from a variety of recent studies and articles. These are offered in part as confirmation of our overall conclusions and as a set of useful and interesting perspectives on the subject.

- The Conservation Council of Ontario, *An Environmental Strategy for Ontario: Draft for Public Review*. Toronto, July 1990:

  > The Ministry of Municipal Affairs and other development ministries and agencies must play a role in targeting development pressure onto specific areas and regions through urban intensification and transportation planning measures.
  >
  > All new infrastructure (roads, transit, sewers, etc.) should support the redevelopment and intensification of existing low density urban areas.
  >
  > Municipalities can promote increased densities through the conversion of commercial-industrial areas to residential use and increased housing densities on main streets.
  >
  > This growth should be carried out in the context of sound community planning in order to ensure that the development supports community goals for safety, recreation, transportation, aesthetics, etc. (p. 18).
  >
  > The Ministry of Municipal Affairs, the Office of the Greater Toronto Area, and local governments should increase density requirements, with a specific aim to facilitate public transportation and protect open

space and agricultural land. Human scale development should be the guiding principle amidst urban intensification (p. 21).

- The Ontario Round Table on Environment and Economy. *Challenge Paper*. Toronto, 1990. Section on Cities and Towns:

  The following directional changes are consistent with the six principles of sustainable development ...

  - increase urban population densities.
  - review the impact of different growth patterns (sprawl vs. compact, higher density vs. low, centralized vs. decentralized) and their compatibility with sustainable development in Ontario (p. 32).

- City of Vancouver Task Force on Atmospheric Change. *Clouds of Change*. Vancouver, 1990:

  Recommendation 19:

  That Council direct the City Planning Department and City Finance Department to make access by proximity rather than access by transportation a central focus in the City's new City-wide plan and to include proximity policies and incentives as proposals for public consideration in the planning process (p. 4).

  Why do we drive as much as we do? Our needs for transportation arise directly out of the way land is used in our community. Through zoning and other techniques, land-use patterns and densities dictate travel volume, directions, and modes to a great extent. To encourage people to use the transportation system more efficiently, we need to adopt land use policies which reduce our needs for transportation and let us meet those needs in more energy-efficient ways (p. 45).

- Peter Calthorpe. "The Urban Context". In Sim Van der Ryn and Peter Calthorpe, eds. *Sustainable Communities: A New Design Synthesis for Cities, Suburbs and Towns*. San Francisco: Sierra Club Books, 1986, 1-33:

  For the environmentalist, the city is a mixed metaphor: on the one hand symbolizing the congestion, pollution, and waste that modern culture has created, and on the other, a compact alternative to the constant invasion of open space (wilderness) represented by modern sprawl. The old pattern of the city, with its mixed use, active pedestrian streets, public transit systems, and public spaces had a human dimension born of technical and environmental necessity.... Originally, cities demanded less of the environment in terms of land and energy simply because accessible land and cheap energy were not available. In this sense, they are a model of conservation and material frugality.

In older cities and towns, the framework and traditions for compact and efficient communities are already in place. Not to reuse them not only wastes the material, energy, and ingenuity that created them in the first place, it squanders our history and depth (p. 1).

- Ron Kanter. *Space for All: Options for a Greater Toronto Area Greenlands Strategy*. Toronto: Queen's Printer for Ontario, 1990:

  Recommendation 13. As a general approach to reducing the amount of land that is developed, as opposed to reducing the amount of development, all levels of government be encouraged to investigate and promote more compact urban forms (i.e., intensive versus extensive forms of development). Concepts such as cluster development and more creative layouts sensitive to the surrounding landscape should be explored.

  To help facilitate moves in this direction, the Province, through the ministries of Municipal Affairs, Housing, Natural Resources and the Environment, would research the matter and prepare a guideline document (p. 163).

- Ontario Environmental Network. *Sustainability As If We Mean It*. Toronto, 1991.

  A Compact Communities land-use policy is needed to promote measures such as:

  - increased medium-density suburbs and narrower residential lot frontages;
  - rental flats and duplexes in single-family residential areas;
  - infill of shopping centres and low-density office parks;
  - redevelopment of suburban arterial roads as "main streets";
  - development of low-rise residential accommodation above storefronts in commercial areas" (p. 53).

- Duncan McLaren, Friends of the Earth, Great Britain, "Higher Densities—A Revival Path for Cities?" *Town and Country Planning*, 59 (December 1990):

  The form of the built environment is a long-term investment, and massive renewal and reconstruction would be itself wasteful of resources; yet many existing forms and current changes are not compatible with policies of sustainability. Although urban forms in the U.K. are more sustainable than those in the USA, where urban sprawl is much greater, they are often less so than those elsewhere in Europe—and even there further improvements are needed (p. 346).

> The revived city will be a 'garden city'—greener, less polluted, denser and reclaimed from the car, giving urban dwellers improved access to jobs and other facilities (p. 347).

- Metropolitan Toronto Planning Department. *The GTA: Concepts for the Future*. Toronto, November 1990:

  Regarding "Concentration," as distinct from Sprawl and from three intermediate alternatives "which may be more feasible: Fingers, Deconcentrated Centres and Re-investment Centres."

  > It has environmental benefits resulting from the likely impact on commuting, reduced land consumption, the focusing of servicing dollars on upgrading and enhancement of existing infrastructure. However, the overall quality of life may suffer from several perspectives, including public resistance to significant neighborhood change and the potential disruption to the sense of community that existing neighborhoods have strived to develop (p. 61).

  The report goes on to note, for example:

  > New medium density forms of housing of high quality close to employment oriented to a network of transit, are key to this (Re-investment Centres) scenario. A more urban environment along suburban main streets would offer variety and animation to many neighborhoods (p. 63).

- Canadian Institute of Planners. *Reflections on Sustainable Planning*. Workshop held in Montreal, September 7-9, 1990:

  > The urban issue that arose most frequently was concentration of the nature of the urban form itself. But of almost equal interest were questions concerning the relationship between the city and its surrounding region. The arms length impacts of urbanization were referred to often. (Consider, for example, the percentage of the James Bay region affected to supply energy to Montreal) (p. 13).

  After setting out three objectives (reduction of per capita emissions, reduced consumption of natural resources, and improved efficiency and cost efficiency of measures to implement sustainability) the reporting group

  > ... identified two overriding strategies to achieve these objectives:
  >
  > - Encourage population concentration in human settlements; try to stop urban sprawl.
  > - Optimize urban systems, as single large planning units. Work toward linked centres of high concentration (p. 20).

  Some specific recommendations for action:

  - Review historical ideas, such as garden cities. Why did they go wrong? What can we learn?

- Clarify the basis of public choice. Find out why people prefer low density suburbs.
- Use that information to make concentrated cities more liveable: Once you overcome the technical problems, how do you make concentrated cities attractive so that people will want to live there? (p. 21).

♦ Canadian Urban Institute. *Housing Intensification: Policies, Constraints and Challenges: Background Paper*. Toronto, November 1990:

> Unless the design professions demonstrate that higher densities can increase the livability and vitality of residential neighborhoods, the public will have no compelling reason to accept intensification of residential neighborhoods. As compelling as the environmental, economic and social reasons for intensification it must be demonstrated that the livability and vitality of urban neighborhoods are not being sacrificed.
>
> Canadian cities in the last two or three decades have experienced suburbanization as the dominant mode of urban growth largely through single-family dwellings with very low densities. For reasons that have been discussed in this report, this form of urban development has serious deficiencies: automobile dependence and the high collective costs of this type of development force us to think of alternative ways of how we use the land. As we have seen compared with European standards, we consume twice as much gasoline. European cities have, meanwhile, maintained a sense of vitality and livability at densities that are substantially higher than our standards (p. 30).
>
> ... The intensification of residential neighborhoods ... does not mean the creation of extremely high densities. On the contrary, combined with creative and innovative approaches—as in the Main Streets Program of the City of Toronto—housing intensification can be a way to claim back some of the vitality and livability that have been lost due to decreasing densities and uniform development that dominated the Greater Toronto Area in the last few decades (p. 31).

♦ City of Toronto. *Housing on Toronto's Main Streets*. Toronto, 1989:

> The development and intensification of the main streets outside the downtown presents a major opportunity for the provision of housing, and can result in a more efficient use of the City's existing infrastructure, the transportation facilities, recreational, social and other services that are already in place.
>
> When such housing is spread out in a linear fashion across the entire width and length of the City, its impact will not be one of major urban renewal, but of low-scale intensification. This will not only make the existing retail and hard and soft infrastructure more viable, but will also

reduce the need for those who work in the City to commute. Substantial new housing can be built to meet diverse needs without putting existing policies of neighborhood and industrial preservation into jeopardy (p. 28).

- Lester R. Brown and Jodi L. Jacobson. *The Future of Urbanization: Facing the Ecological and Economic Constraints.* Washington, D.C.: Worldwatch Institute, 1987:

  Inner-city residents of New York use only one-third the gasoline of residents living in the outer regions of the tri-state metropolitan area of New York, New Jersey and Connecticut. And Manhattan residents use on average only 88 gallons of gasoline per capita each year, a consumption level close to European cities. By contrast, each of the 240,000 suburban residents of Denver's metropolitan area consumes some 1,000 gallons of gasoline per year—more than 11 times that of Manhattan's residents (p. 18).

- Francis Tibbalds. "Future of Cities: (Another) 10 Commandments." *Town and Country Planning,* 59 (December 1990):

  Mixed uses: Mixed use zones should be clearly defined in development plans, particularly related to central areas and nodes of activity. The development brief for a site should specify two or more uses, making clear their contribution to the street-level environment. Particular emphasis should be placed on re-establishing residential uses in central areas. High, mixed-use urban densities—provided they are compensated for by generous green open spaces—will help reduce the burden of travel (p. 347).

- Colleen Weir, "A Voice for Balance," *City Magazine,* 11 (Summer-Fall 1989):

  Ms. Weir has been active in Women Plan Toronto, an organization founded in 1981.

  Unquestionably, the most critical fact is that over one half of the population living in poverty are women. Fewer women own or drive cars than men. A further consideration is the economic burden for many single parent families, and women, whether employed or not, who have very different travel patterns and needs than men.

  For example, their trips are not single but multi-destinational, combining work, shopping, picking up children from daycare, and providing children with recreational and medical care. This pattern of travel is often very time-consuming, expensive, and stressful as suburban planning locates services and residences separately.

Further, women who need work are often deprived of career opportunities, as without a car, they have no access to new industrial developments or other job prospects since transit does not go directly from suburb to suburb (pp. 7-8).

- Task Force on Sustainable Development for Peterborough Area. *Report*. Peterborough, 1991:

  A compact urban form is an essential component of a sustainable community. The process of intensification offers several advantages for land-use in terms of sustainable development:

  - Intensification allows urban areas to grow in population without taking up additional land, particularly agricultural lands.
  - Higher densities reduce servicing costs to the municipality, developer and resident. (More affordable housing can be an outcome of intensification.)
  - Density increases allow the development of more effective public transit systems which can reduce private automobile traffic.
  - Within compact communities, transportation options such as bicycling and walking remain viable.
  - Higher density housing requires less energy for space heating.

  Intensification should be combined with mixed zoning policies that allow for combined residential and commercial developments. Mixed use allows for the development of more sustainable community transportation practices (p. 8).

6. Is There an Optimum Urban Density?

CLEARLY there are substantial and varied environmental gains associated with reducing urban sprawl. But is it not possible that while some intensification is environmentally desirable, too much intensification can result in an urban form where disadvantages outweigh advantages? In terms of environmental factors alone—especially land use, energy and materials use, and regional and global air quality—it would appear that this is not the case. There are additional environmental gains associated with moving from high to very high densities. However, there may be diminishing returns. That is, the gains associated with intensification from low density to medium density to high density are proportionately greater than those from high to very high density.

Consider here Figure I in Appendix 1, which plots gasoline use per capita against urban density. There are substantial reductions associated with the differences between Houston, Phoenix, Detroit, and Denver, on the one hand, and Chicago, New York, the group of Australian cities, and Toronto on the other. Modest density increases result in increases in public transit use, cycling and walking, and reduced average automobile trip distances. There is a substantial improvement as well between this group and the array of European and Asian cities clustered in the 10,000 to 20,000 MJ per capita range. But the radical increase in density between this group and Hong Kong does not result in improvement proportionate to that achieved all along the line from Houston to Vienna, Singapore, and Tokyo. Thus, if there were non-environmental objections to very high density levels one might conclude that the European standard (in cities such as Amsterdam, West Berlin, and Vienna) was an appropriate long-term objective.

Strictly environmental factors other than transportation energy (gasoline use per capita) should also be considered. The land consumption rate, for example, will be inversely proportional to density regardless of how high densities get. That is, if land is a limiting factor even higher densities may be appropriate. Air quality, however, is a more complex consideration. Regional air quality varies with climatic and geographic factors as well as density. It is a much more serious problem in some locations (e.g., Los

Angeles, Denver) than others. But regional air quality is also a function of total population size as well as density. That is, the New York region may produce significantly less air pollution per capita than Detroit, but there are many, many more people. The total output of nitrous oxides and particulates, for example, is very high. In addition, New York is set within the very large complex of cities from Boston to Washington, D.C. Only prevailing westerly wind patterns and the proximity of the Atlantic ocean keep the health effects of these pollutants within bounds. As it is they are far from negligible. Nonetheless, it must be reiterated that this is not an argument against increased density, but rather a strong argument for its particular importance within this region.

Visioning extreme densities

The question of optimization can be better understood if we try to imagine the most extreme possible opposite of urban sprawl. What very dense urban forms can be conceptualized beyond those which actually exist now? The American architect Paolo Soleri has built many scale models of single structures which house 25,000 to 100,000 persons and which contain within them all the activities which occur in existing cities. Transportation within is primarily by foot or elevator. These 'arcologies' are set within nature but would have the most minimal possible impacts upon it. One model 'arcology' is set on pillars so that the total land consumed is minimized even further. Access to relatively wild nature is achieved by going down the elevator and out the door of the structure. Passive solar energy design features allows for only minimal energy demands for heating and cooling. All residential spaces have visual access to the outdoors (reducing lighting demand). All residences also open onto the cultural/commercial/productive core of the structure. Food is produced within greenhouses and on land proximate to the arcology.

The vision is at once arresting and, to many, frightening. It is the diametrical opposite of both the back-to-the-land environmentalism of the 1970s *and* the spirit which continues to propel the contemporary North American city ever-outwards. Soleri himself, it is interesting to note, lives and works near Phoenix, Arizona, a city of the lowest possible density. His conceptualization captures the possibilities of its exact opposite, both the positive and the negative possibilities. It is important to see that within this extreme of intensification, environmental impacts could continue to be reduced. Soleri's vision may be neither economically feasible nor socially desirable, but the vision it captures helps us to understand better both what is wrong with our contemporary cities and what is right.

Thinking about arcologies and optimization leads to three very important conclusions. First, *how* we intensify is more important environmentally

than *how much* we intensify. There is no automatic upper limit on intensification though there is suggestive evidence that the rate of gain on some variables declines once levels typical in much of present-day Europe are achieved. Second, there can be no complete separation of environmental and social factors. The 'how to' of intensification must take both sets of factors into account. Urban life must be exciting, comfortable, pleasant, enriching, convenient, secure, and beautiful. The environmental gains attendant on intensification will be more quickly and securely achieved when many people choose this option freely for largely non-environmental reasons. Third, planners must never lose sight of the importance of human scale. This is important in determining how intensification is integrated into existing streets, neighborhoods, and communities.

Considerations of scale also have a wider importance in terms of the province of Ontario as a whole. Ontario contains communities of almost every possible size. There are innumerable hamlets and villages, a large number of small to medium-sized towns and cities, and one very large and rapidly growing metropolitan area. Intensification can make an important contribution at each of these community sizes (scales). Setting rural homes within a hamlet (within walking distances of churches, a school, a small library, a grocery store, a village restaurant, and a bank) reduces the impact upon the landscape. Rural severances, in contrast, reduce available agricultural land, undermine the rural character of the countryside, and create a total dependence upon motorized transportation. (Again, see Figure II in Appendix 1, which shows that smaller communities absorb considerably more land than larger ones per additional unit of population.)

In small- and medium-sized cities, which actually have a higher land consumption rate than big cities (Yeates, 1985), the opportunities for intensification are frequently considerable. Since, we assume, land costs there are generally lower, affordable medium-density housing should be achievable near to both arterial roads and urban cores. Relatively compact medium-sized cities allow residents to walk or cycle to most, if not all, locations and help to make a quality bus service more economically feasible. Reducing travel distances is important within cities of all sizes.

7. ENVIRONMENTAL FACTORS, SOCIAL FACTORS, AND NIMBY

INTENSIFICATION projects frequently meet with opposition from neighboring residents. This opposition is sometimes characterized as evidence of the NIMBY (not-in-my-backyard) syndrome, that is, a selfish rejection of projects that are socially or environmentally worthwhile or even necessary. The term NIMBY has also been applied to communities that resist landfill sites or hazardous waste facilities.

Neighborhood opposition to intensification may be moderated through education about the environmental and social advantages. This education has been lacking in part because few environmental organizations have stressed the positive aspects of urban life. Nor have many environmentalists, until recently, been sufficiently clear about the importance and urgency of changes in urban form. The focus, rather, has been on the protection of wilderness areas, or industrial pollution abatement technologies, and regulations, or relatively minor consumer habits. It has not been widely appreciated by environmentalists that the most important factors may be the sort of structures we live in, where we live in relation to where we work and shop, and the means by which and the extent to which we travel on a daily basis.

However, neighborhood concerns are often justified. Changes in people's lives may be taking place over which they may feel they have no control. In some cases a particular project may be badly designed, and may impose costs without providing any compensating benefits.

One objection, as has been noted, results from a fear of greater traffic on a street or within a neighborhood. This concern might be characterized as a "micro" scale environmental concern. Even if traffic is significantly reduced across the city or region (the "macro" scale) it might increase on the "micro" scale, within the neighborhood, where intensification is to take place. The distinction between "macro" and "micro" does not diminish their importance to affected persons. As with NIMBY reactions, labelling may add to understanding, but may not offer solutions.

Objections arise for a variety of other reasons. For example, proposals may be seen as being out of proportion or character in relation to existing structures in a neighborhood. The new building (or buildings), it is feared, will crowd people into the neighborhood. The new buildings may be perceived as less attractive, or of lower quality, than existing buildings. Implicit in such concerns are three others:

- fear of a decline in property values,
- fear of socially undesirable (usually less prosperous) neighbors, and
- fears that existing services (such as parks, schools, and so forth) will be overburdened.

Frequently, these various concerns are mixed together and not very clearly thought through. As Lewinburg (1987) observed: "the social fears of most communities, that neighborhood intensification will destroy the way of life which they now cherish, is not based on a real understanding of what is likely to happen. These concerns represent a fear of the unknown which cannot be substantiated" (p. 73).

However, such fears may also be based on a sense that intensification is not part of a larger plan to create a more livable city and region. Overall intensification plans have rarely been publicly and clearly developed. Such undertakings are crucial. It is one thing for people to accept change which assures that green space or farmland will be protected within or near the present urban region. It is another to sense (rightly) that rapid development will take place in the core *and* at the fringe simultaneously. It must be clear that one form of development to some extent replaces the other. Otherwise, the sense of "crowding" is compounded.

There also must be a clear perception that we have broken with a past which saw pleasant, low-density neighborhoods bulldozed in favor of ghastly, slab-like, high-rise apartment blocks. People are very sensitive to design considerations, both as potential buyers and as neighbors. If members of the public can be drawn into the design process in a genuine way, they are more likely to welcome change. (On this point see Section 10.) Developers who appreciate that projects must be welcomed by neighbours, rather than merely tolerated or ignored, will take greater care in designing amenities. For example, new structures might offer services which are useful to neighbours as well as to residents. All of these matters can be raised within an open process of planning and design. Most objections, we believe, can be met within such a process. The experience with NIMBY reactions is that public participation, overview planning, and careful design go a long way to gaining acceptance.

But before such a process can be established and accepted there must be a wider public understanding of why intensification is appropriate. The positive design possibilities for achieving a quality urban environment must be more widely appreciated. Specifically, it should be effectively communi-

cated that density increases can both improve the quality of urban life and make a significant contribution to protection of the wider environment. The linkage between density, automobile use, and air quality must be established. One way to make this clear in policy terms is to link density increases to public transit improvements or incentives. The linkages between density increases and green space (or farmland) preservation should also be made clear. This could be achieved by presenting alternative long-range plans for development of a city or region. Another possibility is to apply fees associated with zoning density increases to conservation easements on other (undeveloped) lands.

One way to learn how to encourage the acceptance of projects which increase urban density is to study the longer term response of neighbours to existing projects. The City of Vancouver Planning Department has completed such a study (City of Vancouver, 1984). This study found that while some immediate neighbours continued to be concerned about such projects, others did not and few had seen any very specific concerns realized. The report concluded that new infill housing was "better accepted by nearby single-family residents when it was:

- Located in already heterogeneous areas near transportation, shopping, and other services,
- Clearly family housing;
- An improvement over previous (derelict or incompatible) uses; and
- Accompanied by a community facility such as a park" (City of Vancouver, 1984).

Early, effective public participation is the best way to ensure environmentally and socially appropriate intensification. Residents are generally very skilful and exhaustive in identifying all the potential impacts of changes to their neighborhood. Early public participation helps to ensure that these impacts are known and addressed in the design of the development.

Such public participation is also the best way of overcoming the biggest hurdle to intensification: opposition from neighboring residents. Opposition to projects is generally exacerbated by residents' feeling that they have lost control over their neighborhood, and that change is going to be imposed upon them. Indeed, control itself may be a bigger real issue for people than any of the specific complaints they raise.

A more participatory planning process might go a long way to alleviating local resistance to intensification projects. Neighbors should be asked to comment on the additions to their community or neighborhood. Redevelopment of a neighborhood should be seen as an opportunity, and made to be a source of excitement rather than a threat. People should be genuinely involved in helping to design the future of the area in which they live. A process conceived in this manner may be a good way to make intensification

work—not just to get housing built, but to create vital, attractive, safe, sustainable, comfortable homes and neighborhoods.

A paper on intensification and the environment cannot, however, provide a detailed plan for resolving the many objections that might arise to particular intensification proposals. The three remaining sections of this report do, however, deal with the "how-to" of intensification. In this the report takes a more comprehensive approach than has been common in the past. It is hoped that initiatives brought forward in this spirit not only obtain necessary public approvals, but help to make Ontario's cities more appealing and comfortable places to live and work and play.

8. MAXIMIZING ENVIRONMENTAL OPPORTUNITIES WITHIN THE INTENSIFICATION PROCESS

HAVING considered the "why" of intensification, we now turn to the "how". Before addressing a variety of detailed, but very important, points, we want to state the overall objectives of these concluding sections. It is vital to be clear at the outset (and throughout the long process of urban intensification) that intensification is *not an end in itself.* It is a *means to a number of ends,* one of which is reducing the environmental impact of urban land use. This may be the most important single objective of intensification, but it is not the only objective. Indeed, environmental objectives may not be met if social and economic objectives are ignored. These other objectives (ranging from affordable housing to helping to rehabilitate Ontario's downtowns) must be addressed within the intensification process. In brief, people must want to live and work within the changing urban form rather than at its periphery. The more compact urban form we seek must meet people's needs more effectively and more economically than the alternatives.

We will look at social and economic factors in greater detail in section 9. But there is a related and equally important point which must be addressed here. Environmental ends are not society's only ends, and intensification in and of itself is not the only means to achieve environmental goals. Intensification must be part of an over-arching strategy to achieve, in time, cities which are environmentally sustainable, in resource use and biosphere impact terms. Density increases alone will result in some improvements, but much more important are the wide variety of environmental protection and resource efficiency opportunities which intensification affords. Our cities and our economy are, at present, a very long way from sustainability. Each opportunity that arises should be taken. Gains need to be continuously

maximized and reinforced. Opportunities must be created in relation to those opportunities which arise. It is in this spirit that we approach the question of how to intensify.

Let us begin, then, with a distinction. One must distinguish between the environmental gains intrinsic to intensification (those gains that arise merely by intensifying) and the extrinsic gains (essentially the opportunities which arise within the intensification process). If distances between people and their activities are reduced, less energy will be expended in moving people and goods. That is an intrinsic gain. So too is a somewhat lessened pressure on proximate agricultural lands. So too are some of the energy and materials gains associated with a higher proportion of the population housed in more compact or in multiple-unit dwellings. But these gains, as important as they are, may be less important than the opportunities created by a commitment to a long-term process of intensification and urban reorganization. Much more can happen *while* densities and configurations change and develop. Within that process, cities can evolve which are both more compact *and* more livable, more sustainable *and* more equitable, more dense *and* more comfortable. This can be achieved, in time, if intensification set in the context of a variety of complementary initiatives which help to maximize opportunities and minimize risks.

This section emphasizes the environmental opportunities which may arise within the process of intensification. We will begin with transportation-related opportunities. Under that heading we consider: (1) questions of proximity, (2) the potential regarding built features, and (3) some of the possibilities for complementary policy initiatives. We then consider non-transportation opportunities. These are grouped under four headings: (1) construction (individual unit design) opportunities, (2) configuration (collective design) opportunities, (3) physical setting (non-built features and options), and (4) complementary policy initiatives. From time to time the social significance of these matters will be touched on, but, again, a more extended discussion of relevant social and economic issues will be put forward in section 9.

Transportation-Related Opportunities

Questions of Proximity

Recent research on transportation and urban density shows clear and consistent relationships that offer guidance to urban intensification. Newman and Kenworthy (1989) found that at densities below 30 to 40 people per hectare, automobile and gasoline use increase exponentially. At roughly 30 or 40 people per hectare and above, a more diverse and more environmentally desirable transportation pattern emerges. Automobile ownership and, more important, automobile use declines as density increases beyond that

point. At densities over about 100 people per hectare, another distinct threshold is passed: public transit is increasingly supplemented in favour of walking and cycling (Newman and Kenworthy, 1989, pp. 47, 128-9. See Figure I in Appendix 1).

As noted in an earlier section, Holtzclaw (1991) shows that, as a general principle, per capita vehicle miles travelled per year decrease by about 30 per cent as population density doubles. How this occurs is highly instructive. Goldstein, et al. (1990) found that (in California) "inducing one passenger mile of ridership on transit reduced community-wide vehicle miles travelled by 10 vehicle miles." That is, there is "a consistent pattern of high leverage for policies that increase transit usage and development densities" (Goldstein, et al., p. 6). The reason for this result "appears to be that the availability and usage of transit services also changes the location of trip origins and destinations in a way that reduces the need to travel by car, and reduces the distance of travel required by the majority of people who will continue to drive their cars" (Goldstein, et al., p. 8). There are very important lessons here regarding how to intensify. Density increases should be proximate to public transit services and development should be carried out in association with transit improvments.

It should also be noted that once people are tempted out of their automobiles for the trip to work, they may be more inclined to give them up for some other activities as well. But even if they do not give up driving to work it is probably most important that the variety of non-work activities be more often proximate to residences. Holtzclaw (1991) explains the effects of density on vehicle miles travelled: "Higher density areas are richly served by neighborhood businesses. Residents of areas with higher density, more local serving businesses (restaurants, markets, etc.) and better transit drive less, not only because jobs are closer and more accessible by transit, but also because shopping, entertainment and recreational destinations are too. And these latter destinations comprise four-fifths of total trips and two-thirds of total mileage." (The most important results of Holtzclaw's study are presented in Figure III in Appendix 1.) In other words, intensification should be proximate to as many frequently visited destinations as possible. It should occur, for example, within or near the downtown core and along major arterial routes that are well-served by transit. Or, services should be incorporated within or adjacent to new developments (or conversions). The choice of services so located should be based on frequency of use and on the profile of likely residents (medical services for the elderly, day care for young families). Perhaps the best way for planners to determine which services and facilities are most important in a given location is to involve in the planning process those who already reside in the neighborhood.

Proximity to non-service employment is sometimes more difficult to achieve within the planning process. Dispersing industry within residential areas does not guarantee that there will be a match of residential and

employment locations. The jobs located near to a residential neighborhood may be held by people living elsewhere. For public transit to be effective for daily trips to work, work locations must be clustered in a central area, or a small number of nodal points (Newman and Kenworthy, 1989; Holtzclaw, 1991). That said, however, other factors come into play. Manufacturing must be proximate to the most appropriate means of shipping both raw materials and finished products. But most important in terms of environmental impact, both industrial and office employment must be accessible to employees by viable, cost effective, convenient public transportation.

Building in priority for pedestrians and cyclists

It is very easy to ignore walking and cycling within the process of transportation planning. These most environmentally friendly modes of transportation are not seen as transportation at all. Rather they are looked at in their recreational functions alone (Hawthorne, 1989). The perception is that they are pleasures, to be enjoyed as such, but that when we get down to everyday business there is no time for such joys. Our cities in large measure are planned accordingly. It is difficult to know how often additional decisions to walk or cycle would be taken if these modes were safer, less intimidating, or encouraged along more interesting paths. As a British analyst recently put it: "There are few people now who will say: 'Oh I'll walk it, it's only 20 minutes.' It is easy to dismiss this as laziness, but time pressures and the frequent unpleasantness of walking along a street with narrow pavements and heavy traffic play their part in encouraging people to 'just nip into the car'" (Bowers, 1990).

What, beyond population density increases, can be done to alter the built environment in ways which will accelerate modest shifts toward cycling (and walking)? Many things, not the least of which is the realization that to a great extent walking and cycling become safer and more pleasant options the more frequently they are adopted. A city in which walking as a means of transportation is genuinely possible is one that promotes community, sense of place and environment, and living on a human scale. Walking requires no non-renewable resource inputs. It improves health and fosters both social contact and a more acute awareness of the local environment. It is free, and equally open to people of all income levels.

The following sorts of measures supportive of walking and cycling and wheelchair use might be seen as appropriate:

- Traffic lights and stop signs should be frequently spaced to provide pedestrians with protected crossings in high traffic areas.

- Buildings, streets and transit vehicles should be designed to accommodate baby carriages, shopping carts, wheelchairs and bicycles.
- All residential areas should be built with sidewalks. Leaving them out (or even on one side of the street) is a major disincentive to walking.
- In more heavily used areas, sidewalks should be made more appealing with features such as good lighting (with energy efficient fixtures which direct the light downwards to where it is used), benches, shelter and greening. (Regarding outdoor lighting see Dickinson, 1990.)
- Walking is also encouraged by networks of pedestrian pathways that connect parallel residential streets, or connect residential streets to nearby main streets (especially where those main streets have been intensified both residentially and commercially).
- Sidewalks through the middle of parking lots to assert pedestrian access.
- Separate lanes or paths for bicycles should be established whenever possible—even covered routes should be considered as use warrants.
- Covered, secure parking for bicycles should be incorporated within all residential, commercial and industrial locations. Here is an example of the opportunities afforded by new intensified residential construction, conversions, and renovations.
- Shower and/or towelling-down facilities should be provided for cyclists (or those who jog to work) by employers, especially by those who provide automobile parking for employees.
- Automobile-related and other barriers to pedestrian and cycling traffic should be reduced or eliminated.
- The wide range of measures frequently identified as traffic-calming (or pedestrianization) should be adopted in some residential locations. These measures, designed to slow traffic, will make walking and cycling both safer and more pleasant. They include, for example, reduced traffic speeds (to walking levels), narrowings and obstacles that restrict cars but allow free passage to bicycles; parking restrictions; and extensive tree planting. (See Taylor and Newton, 1985; Deelstra, 1990; Lennard and Lennard, 1987.)
- Critical to the appeal of walking and cycling are streetscapes. Walkways must be diverse and interesting. Every opportunity should be taken to create sidewalk oriented commercial establishments along routes frequented by pedestrian traffic (proximate to public transit and residential neighborhoods). Malls, large and small, for example, are set well back from the street, and parking has street frontage. Simply reversing this would make shopping by public transit or foot more appealing for many people. Interestingly, the *New*

York Times reports that a modest trend to convert shopping malls to more traditional "downtowns" has recently developed in New England (Flanagan, *New York Times*, March 14, 1991).

- Finally, the pedestrian infrastructure should be designed with the needs of all members of the community in mind. Sidewalks and intersections should be accessible and safe for parents with baby carriages, people in wheelchairs, the elderly, and others who need more time to cross streets.

Complementary policy initiatives

Obviously there is much that can be done to encourage public transportation ridership as well. But initiatives relating to the physical design of transit facilities are well enough known to avoid treatment here. We do look briefly below at policies and incentives to encourage greater public transit use.

One policy option most effective in shifting people from private automobiles to public transit is a decision by employees to stop supplying free parking to employees. This is a very low cost strategy for government (which need do little more than encourage the option), for industry (which should actually save money), and employees (who could be given pay raises equal to the parking fees). Research shows that results of such a change are remarkable. Willson and Shoup (1990) found that employer paid parking greatly increased solo driving and that when employers reduced or removed parking subsidies, a significant number of drivers shifted to car-pools or transit. On average, in five case studies, when drivers (rather than employers) paid for parking, four of ten solo drivers switched. Auto trips decreased by 27 per cent, from 70 per 100 employees to 51 per 100 employees. The cost shifts which induced these changes were on the order of $30 per month. Most of the cases studied were in Los Angeles where public transit is notoriously poor, and many of the shifts were to car pools or van pools. (Willson and Shoup's data are presented as Table VI in Appendix 1.) Employers, including public sector employers, could also take an additional step: they could include public transit passes as an employee benefit (and government could choose not to make this a taxable benefit).

In another context, more radical steps have been taken with good effect. Singapore instituted an Area Licensing Scheme (ALS) in 1975. Since then, all private cars have had to obtain a supplementary licence to enter a restricted zone, including most of the central business district. Other measures including higher parking fees and improved public transportation were also instituted. During the period 1975-85, the ALS was instrumental in eliminating or postponing road investments of US$500 million. By 1992 that total is expected to rise to US$1.0 to 1.5 billion. Some European cities have adopted similar measures. Short of special permits, other steps can be

taken such as reserving faster lanes for cars carrying passengers, or simply increasing urban core parking fees. Another possibility is providing urban core public transit stops with locations that are significantly (or even marginally) more convenient than are parking facilities.

Another important approach is to calculate (and reduce) the wide range of existing subsidies which all Ontarians and Canadians provide for automobile owners and users. According to the Canadian Automobile Association, it costs the average new car owner about $7,000 a year to own and operate a vehicle—not including parking. A recent study by a Quebec environmentalist calculated the hidden subsidies to driving by all levels of government at an additional $5,000 per car owner per year. Public subsidies include highway and road construction and maintenance, the 40 per cent automobile-related proportion of policing costs, publicly supported traffic and traffic accident services, the provision of parking by public authorities, street lighting, traffic management services, and so forth. A significant proportion of hospital and medical costs are also the result of automobile accidents, and in Canada these are borne from the public treasury. According to the Worldwatch Institute of Washington, D.C., incorporating the hidden subsidies to automobiles into the cost of fuel would bring the U.S. retail price of gasoline to $4.50 per gallon (Renner, 1989, p. 111). The total subsidy has been estimated at U.S.$300 billion.

One means of seeing through subsidy concerns is to calculate the subsidy, add the costs of air pollution, and provide an equivalent subsidy to public transportation systems. Alternatively, government could pass calculated costs through to car users in increased licence fees (possibly geared to vehicle fuel efficiency), gasoline taxes (e.g., the carbon taxes proposed by some environmentalists as a means of achieving CO_2 reduction targets), urban core parking fees, or some combination of these. Another possibility, perhaps the most radical notion of all, would be to pass some of this new revenue through as a rebate to those who do not own automobiles. Stanley Hart, a California environmentalist and highway engineer, argues that each automobile owner in his city (Pasadena) should be assessed a special tax of $2400 (equal to his estimate of the subsidy provided to each vehicle in that state) (Lyman, 1990). This scheme, however, might have a regressive social effect, even if other taxes were reduced comparably. Automobile ownership, as well, is far less significant environmentally than heavy use of inefficient cars. Further, cars are not equal in their environmental impacts, and this tax would do nothing to shift from dirty, inefficient cars to clean, efficient ones. A subsidy to non-owners would direct significant payments to the elderly, the poor, students, and others. There might be no more equitable possible means of income redistribution (assuming that dishonest collection could be minimized).

Also possible are improved efforts at persuasion. Civic and business leaders can set an example. Creative ways must be found to break the

monopoly on status held by the automobile within North American culture. People of means are often embarrassed to cycle to work or to ride public transportation systems. However, a recent article in *Environment* magazine reports that Zurich, Switzerland "has succeeded in persuading its businessmen and professionals to go to work by public transport, an activity now seen as an expression of public virtue" (Boehmer-Christiansen, 1990). The current enthusiasm for environmental protection offers a real opportunity to change the habits of at least a segment of the population by persuasive means.

Time is probably the main reason autos are chosen over transit (or vice versa). Newman and Kenworthy (1989) found that average bus speeds are very consistent at about 20 kilometres per hour in the major cities around the world. Buses cannot, thus, compete with cars for speed. Rail-based transit systems, particularly those with unobstructed rights of way, are more competitive. But they are only viable at relatively high population densities and passenger volumes. Consideration should thus be given to helping to speed the movement of buses. The Toronto experiment on Bay Street (creating a lane for buses, taxis and bicycles) is very promising in this regard. So, too, is the possibility of creating traffic signals that can be controlled by transit vehicles such as street cars and buses.

Finally, the interdependency between public transportation and urban density can be reiterated by way of an example. The San Francisco Bay area communities of Walnut Creek and Danville-San Ramon were similar sprawling suburban bedroom settlements when the Bay Area Rapid Transit system (BART) opened in 1975. Two BART stations were developed in Walnut Creek, while Danville-San Ramon is minimally served by transit. By 1988, Walnut Creek had twice the density of Danville-San Ramon, 3.5 times as many local-serving jobs, eighteen per cent less auto travel per capita, and 37 per cent less auto travel per household. Walnut Creek households spent nearly $7,000 less per year on automobile costs, used 90 gallons less gasoline per person per year, and emitted proportionally fewer pollutants (Holtzclaw, 1991). Thus, intensification and public transit can be established directly and simultaneously. The array of policy encouragements discussed here can improve utilization rates significantly, but quality transit systems and appropriate urban forms must first be established.

Non-transportation environmental opportunities

Individual Unit Design and Construction

- Passive solar features - consider building orientation whenever possible, use large south-facing windows and more modest north-facing windows, use awnings or deciduous trees to south, etc.
- Insulation - adopt very stringent overall energy efficiency standards (R-2000, ASHRAE-90) for intensification projects. If cost-effective, this might include the use of low-emissivity windows and other state-of-the-art materials.
- Heating systems - use high efficiency natural gas or ground source heat pumps or other high efficiency heating and cooling systems. Consider use of such advanced technology options as room activity sensors (for lighting and heating), etc.
- Maximize the use of natural lighting. A study done for Ontario Hydro found that this option (called "daylighting" and including windows, skylights, atria, and passive and active optical systems) was far and away the most cost-effective energy efficiency option for a variety of office buildings. This would be less true in residences, but the figures (164.1 per cent annual return on investment) would suggest these steps are worth taking in any structure (Sai-Chew, et al., 1988)
- The Region of Ottawa-Carleton has established maximum KWh/m^2 heating and lighting standards for new developments—targets well below average efficiencies should be set for all intensification projects.
- In all selection of equipment and features it should be kept in mind that build-ins at the outset of construction can cost as little as 10 per cent of retrofits. As well, buildings themselves should be built with the assumption that they will last for a century or more. Some attempt should be made to anticipate the needs of the long-term future.
- In multiple dwelling units, electricity consumption in individual units should be metered separately rather than in bulk for the building as a whole. Studies have shown that this will result in average savings of 30 per cent.
- In general, baseboard electric heaters should be avoided as they are a highly inefficient source of heat.
- High plumbing standards should be adopted to promote efficient water use. They should include showerheads and toilets, jet sinks and individual water meters.

- Rainwater run-off collection systems (either rain barrels or neighborhood cisterns) should be installed for lawn watering, especially where water is scarce.
- Kitchens should have easy and flexible built-in facilities for source separation, recycling and composting. Capacity should be included for future materials such as fine paper, cardboard, plastic bags, household hazardous wastes, etc.
- Multi-unit buildings should include fire-safe storage and easy movement facilities for recycling, including a wet-dry separation option (or compost collection capability).
- Neighborhoods should have a built-in indoor or outdoor space which can be utilized for periodic "garage" sales (the bicycle storage room?).
- Low-impact construction practices should be required, especially the recycling of gypsum wallboard, wood wastes, and zero run-off, on-site detention during construction.
- Construction itself should utilize some secondary materials (e.g. recovered brick or architectural materials).
- The building sector is second only to agriculture in its use of chemical products, many of which cause damage to the environment at the point of production, when used, and at the time of demolition. Great care should be taken in the selection of building materials. (See Deelstra, 1990.)
- Most important: existing buildings should be refurbished, retrofitted, converted or incorporated whenever and wherever possible. This option makes it easier to integrate new architecture into the existing built environment of a neighborhood. Stokes (1979) reported that the cost of completely rehabilitating existing units through "self-help" (resident labour inputs guided by skilled professionals) was half the cost of rehabilitation by contractors. More important, it was one-third the cost of new units. As Stokes put it: "In addition to preserving architectural diversity, housing conservation strengthens existing neighborhood resources and heightens the sense of community" (p.12). Environmentally, the savings in both materials and energy are considerable. Densities can be enhanced by a mix of infilling, conversions and/or renovations.
- The size of individual units should include a fair number of more modest sized units (e.g. with sleeping lofts to maximize the use of space). The environmental logic is obvious here, but it should also be noted that Canada's demographic shift towards an aging population and the growing number of single-parent (and smaller) families suggest that there would be a demand for attractive and creatively designed compact residences.

Configuration and collective design environmental opportunities

- Shared public and green spaces should be designed to maintain higher densities and provide enjoyable and useable outdoor space. Access to some of these spaces can be limited to residents of a multiple dwelling or a block. They should include access to shared recreational facilities (e.g. picnic tables, barbecues, sports equipment such as table tennis, volleyball, swimming or wading pools, etc.). This practice both shares resources and reduces land consumption.
- Designers should take great care to optimize the solar orientation of outdoor spaces. Public outdoor spaces should be located to the south and west of buildings, spaces for cars to the north. There are dense residential communities in the Netherlands that, by careful design, have every unit facing into neighborhood greenspace or onto water. No residents need stare out at driveways and cars.
- Opportunities, perhaps even requirements, should be made for grocery stores, restaurants and/or pubs, day care, banks (or bank machines) on the block or neighborhood level. On the neighborhood level, plans should include libraries and other commercial-social establishments. Proximity planning must be taken very seriously. It should be assumed that a majority of residents at some density level (greater than 80 or so persons per hectare) will either not own cars, or even if they do, will opt not to use them on an everyday basis. If neighborhoods are not designed on that basis, the possibility will not be there other than for those who simply cannot afford the automobile option. The distance scale of the not-very-energetic walker (or the parent with a five-year-old in tow) should be kept in mind continuously.
- Locations and patterns of development should consider the capacity of existing hard services (roads, transit, sewers). Every effort should be made to work within existing capacities, except perhaps where replacements owing to age are justified in any case.
- Densest developments should be nearest to transit routes. People in the densest development are the ones who use transit most. This makes transit use more effective and provides an attractive incentive for the use of denser housing.
- The potential for shared equipment and amenities should be considered whenever possible. Particularly important here is the potential for block or neighborhood heating and/or cooling facilities. Such facilities (including electricity co-generation) are widely used in Europe, particularly in Scandinavia. Energy efficiency gains, even in

comparison to state of the art individual units, can be highly significant.

- Other shared facilities might include: laundry facilities (including clothes lines), garden equipment, recycling stations, community freezers (with separate access compartments). Some expensive or bulky appliances and equipment might also be purchased collectively by building committees and rented at low cost (e.g. VCRs, camcorders, or even folding beds for occasional guests).

Setting: Non-built Design Features

(Putting the green back into green space)

In intensified areas, a great deal is required of greenspace and this implies that it must be innovatively conceptualized, designed and managed. Not the least of the problems is a softening of the perception that intensified land use implies a radical reduction in natural outdoor space. With creative design, it is possible to double densities from typical suburban levels without diminishing total greenspace. In fact, although it may seem paradoxical, intensification initiatives can be used to *improve* the natural character of the outside environment in urban areas. Perhaps only in this way can more densely populated areas compete with the quite different, but widely appealing, availability of outdoor spaces within traditional suburban configurations.

One objective should be to arrange, utilize, and plant outdoor spaces in such a way that they are more, not less, natural than the lawns and gardens typical of contemporary suburban life. Naturalized outdoor spaces are characterized by the absence or diminished use of intensively managed lawns and cultivated beds. Various flowering or non-flowering ground covers are commonly utilized, as are shrubs, bushes, and trees rich in food for birds and small mammals. The number of trees should be as high as possible because urban trees play a very great role in reducing CO_2—a role as much as 15 times more significant than that of rural trees (Kielbaso, 1990). Tree species should be carefully selected for their ability to withstand urban pressures, including air quality considerations (Kielbaso, 1990).

Naturalized areas can be very attractive (naturalized is not the same as wild and overgrown) and can serve many purposes. These spaces should offer endless variety. They can be integrated into or linked to walking or cycling corridors (inter-nodal, or inter-neighborhood trails). They can incorporate spaces for outdoor dining, entertainment, recreation, or relaxation. When designed as walking or cycling corridors, the short distance transportation function of such facilities should be enhanced. Paths should go

somewhere useful: a commercial area, a school, or a community public facility of some sort. Every attempt should be made to create green networks which link the various "islands" of greenspace within an urban area. Where possible, the network could connect to areas beyond urban boundaries in order to reduce the inbreeding of animal species.

The extent and usefulness of outdoor spaces can be maximized by keeping private outdoor spaces to a minimum (but including small attractive patios, balconies, or roof gardens). Again, if private or collective greenspaces are on the south side of developments they will be sunny and sheltered from north winds. Building configuration can create a micro or area climate that is quite beneficial. Structures can be built in a rough horseshoe opened at the south (or possibly closed off with a low wall or even an atrium). The microclimatic advantages of such designs are considerable. Some horseshoes might incorporate community gardens. Especially promising here are low maintenance perennial crops such as herbs, fruit-bearing bushes, fruit and nut trees, and so forth. Ownership should be community, neighborhood, complex or building based so that care can be more easily organized and produce can be shared. Municipal ownership would likely discourage such activities as tapping maple trees.

The environmental advantages of naturalized spaces include the following:

- very low chemical inputs (pesticides and fertilizers) and resulting positive effects on stormwater quality;
- improved wildlife habitat within urban areas;
- absorbent soils and absorbing plants to help to reduce stormwater run-off more effectively than would heavily tramped lawns;
- neighborhood or building-based management of open spaces to encourage actions which help to reduce stormwater contamination including poop-and-scoop participation and litter clean-up;
- opportunities for outdoor environmental education;
- encouragement of a sense of place through a diverse stimulating environment and general development of outdoor-oriented aesthetic and environmental values.

Complementary policy initiatives

Intensification will succeed only with the approval and encouragement of public authority. As well, public funds may be expended on the enhancement of associated public transit facilities and to establish more stringent environmental and design standards. These standards might incorporate some of the items identified throughout the preceding portions of this section. The imposition of such standards is necessary to create a level

playing field for all developers. Hopefully they will also disallow all concerned from ignoring long-term environmental quality considerations, as well as long-term operating costs. Standards particular to intensification opportunities should be considered within those communities where extensive efforts of this sort will be undertaken.

Careful consideration could also be given to existing property tax structures in relation to intensification. Assessments of vacant and highly underutilized space should, perhaps, be increased at least selectively to encourage its efficient use. Taxes should reflect the real value of land, including the opportunity cost of land that does not need to be serviced because of sprawl avoidance. On the other hand, consideration could also be given to giving property tax rebates or credits based on the level of compliance with environmental building standards (e.g. energy efficiency or secondary materials re-use). Finally, some funds might be made available for performance bonuses for environmental design innovations.

Policy initiatives related to urban centres should be continually complemented with policy initiatives related to the urban fringe. Agricultural land, wetlands, wildlife habitat and near-urban wilderness and open spaces cannot realistically be protected unless there is a simultaneous commitment to urban intensification. Nor can intensification be completely successful without protective initiatives. They can take many forms. One particularly innovative possibility is to require that those developers who gain the best opportunities for intensification projects purchase (and assign to public authorities or land trusts) land easements or development rights at the urban fringe (Reid and Hilts, 1990). In this way, intensification and sprawl limitation are explicitly linked. In some situations, these private funds might be complemented by a share of property tax revenue increments passing from core to fringe municipalities. The basic approaches to agricultural land protection include: (1) tax incentives (especially low, agricultural income-based, property taxes), (2) land-use controls including exclusive agricultural zoning of prime or specialty farmland, (3) the severance of "development rights" from ownership. It must be noted that it is rare that a single urban municipality has the power to create a greenbelt around itself. Initiatives for such an important protective strategy must come at the regional, county or provincial level.

9. MAXIMIZING SOCIAL AND ECONOMIC OPPORTUNITIES AND MINIMIZING THE RISKS

THIS report is about the environmental impacts of intensification, but there are several reasons why environmental factors cannot be considered in isolation from social and economic factors. First, even with good planning and solid support from government, the newer, more dense urban neighborhoods will compete in the marketplace with less dense housing at the suburban fringe. The combination of economic and social factors will largely determine which option people will choose. Second, as was suggested above, the potential resistance to intensification will likely stem from a combination of economic, social, and "micro-environmental" factors. Third, a more compact city in which social (and micro-environmental) factors have not been handled optimally may find the more affluent of its residents making frequent trips to second homes or regular more distant holidays. Much of the fuel saved (and pollution and congestion avoided) on daily commuting will be consumed on weekly or seasonal escapes. While we would not pretend to treat these matters comprehensively here, we cannot simply ignore them. Environment, economy, and society are integrated on many levels. This is recognized in Ontario's *Environmental Assessment Act*.

Social and economic considerations were at least implicit throughout the previous section (8.). The design of pleasant, interesting, and convenient medium and higher density communities is critical to all three of the concerns raised in the preceding paragraph. As well, high quality intensification should support or enhance adjacent property values and contribute to the quality of life for all residents in the area. But the way in which increased densities are achieved (the "how" rather than the "why" or "how much") is critical. If social and economic factors are not addressed, intensification could have negative social effects. This would be tragic, particularly when there is a potential for a convergence of significant positive social,

economic, and environmental impacts. Understanding this potential requires seeing some of the negative effects of present cities.

In many parts of our present cities and towns, people who do not have cars or do not drive are effectively isolated from jobs, services and community life. This includes, for example, significant numbers of the elderly, women, poorer families, and stay-at-home parents with small children. As well, as Deelstra (1990) put it: "Roads, for the motorist the medium of mobility, restrict the mobility of children and old people; they are a threat and a barrier" (p. 32). This is an example of how our prevailing urban forms contribute to inequity. In contrast, a transportation system which provides public transit, cycling and walking opportunities for access to urban amenities will not only make cities cleaner and more livable, but also more equitable. More compact cities which stress mixed use and proximity planning can further improve upon these possibilities. Also relating to the equity question is the possibility that the average cost of housing, and transportation in combination will decline as cities become more compact. The greatest threat to this possibility is the impact of intensification plans on land values. As Bourne (1976) noted: "the benefits of higher land prices will be received primarily by existing landowners and landlords. The costs will be paid by future generations" (p. 7). Some way must be found to keep the costs of high-quality compact housing, convenient to both public transit and amenities, at a cost substantially below that of suburban housing at the urban fringe. One important ingredient in this is some means of restraining or capturing (for new residents) the rise in land values associated with density increases.

The range of social and economic issues associated with urban intensification is broad. We will limit ourselves here to four: (1) livability, (2) affordable housing, (3) privacy and safety, and (4) social services. Actions taken in each of these areas must be mindful of equity concerns. Intensification is an opportunity for meeting the diverse housing and transportation needs of all segments of Canadian society. Our treatment of these concerns is not meant to be comprehensive, but merely suggestive and a necessary complement to our treatment of environmental concerns.

Livability

Strictly speaking, the term land-use intensification signifies higher population densities and nothing more. But this mechanistic expression does not capture the more complex objectives implied by terms such as "compact community" and "livable city" and "sustainable urban development". As Michelson (1984) put it: "The direction of thinking linking density and livability has largely discarded the question of whether there is an automatic relationship between some standard of high density and some desired or

undesired result. Rather, the direction has turned toward what factors mediate between density and livability. In other words, what is it that's actually there that makes a given density either work or not work?" (p. 9).

To ensure that land-use intensification helps to create more livable urban areas, there should be a number of supporting policies and processes. For example, the "jumble of uses" celebrated by Jane Jacobs and others—in contrast to the monotony of suburban single-use "clean" zoning—is often linked with intensification. But intensification alone may not achieve variety. Land-use policies need to be changed, for example, to permit home occupations and a mixture of residential, commercial, and light industrial activities.

Nor does intensification necessarily hinder another objective associated with livability: human scale. High-rise apartments or office buildings, for example, are generally divorced from the streetscape and the surrounding community. Hence the need to emphasize "ground-oriented" development. The four-to-five-storey target for street-side redevelopment adopted in the City of Toronto's *Main Streets* report is probably an appropriate upper limit in most contexts.

As noted in the environmental section above, intensification can help to shift the balance between self-mobility (walking, cycling, wheelchair use)

The livable city

And why shouldn't a city be fair? Distilling all the qualities common to these appealing places, I find that the biological and aesthetic requirements are simple and well-known. Interestingly, they also provide the antidotes to the sensory monotony and chaos that the scientists warn about. The humane city could have them all:

- Return to human scale in many variations (the basic measure being what we see and feel five to twenty five feet off the ground).
- Contact with growing things and changing seasons, as well as the modulations of light from morning until dark.
- Passive and active involvement in the social action around us.
- Visual comprehension of the processes that sustain the city and its people.
- Variety of form and organization that does not impose one way of acting, living or feeling—i.e., true freedom of choice for individual values to prevail.

- Benjamin Thompson, "Visions of the City", in *Making Cities Livable Newsletter*, April 1988.

Affordable living

Nothing you can do in terms of affordable housing can make such a dent in it as lowering the ratio of automobile ownership. The average cost of owning and operating a car in this country is $4500 a year. That covers a $40,000 mortgage. Nothing you can do in terms of spacing studs or using cheaper materials will do as much to make housing affordable as permitting people to own one car instead of forcing them to own two or three.

- Andres Duany, Public presentation, Orlando, Florida, December 1989.

and motorized high-speed transport (chiefly automobiles). But the primacy of the self-propelled must be carried further in the design of urban space. We need, not just wide sidewalks and paths, but also people-friendly and "walkable" public spaces—squares, markets, pedestrian zones—where a variety of planned and unplanned cultural activities can take place. This principle has particular significance for commercial development, which has increasingly occurred in private, indoor malls where public activity is strictly regulated. In urban areas these malls often present blank walls and/or massive parking lots to the street. They are designed on the "lobster trap" principle to draw people indoors and keep them there. Street-life is deadened. Malls could be designed in ways which are more supportive of street life as well as making available interior spaces for inclement weather. (See Hough, 1990.)

Aesthetic concerns must be incorporated through good planning and design. Many people now associate suburban intensification with ugliness: rows of identical, cheap-looking houses. There is no need for this. Attractive and affordable design alternatives are available. Indeed, intensification should provide the opportunity to create architectural beauty and community fabric rather than destroy it. The building approvals process needs to reflect a community interest in aesthetics and neighborhood. Heritage buildings and other significant features must be incorporated. Even industrial activities can be incorporated and designed to be more open to public view: people are endlessly attracted to construction sites and docks, and some forms of industry could also offer a similar appeal. Opportunities for exciting urban areas are as endless as the human imagination.

Affordable housing

The issue of affordable housing is one of the most important we currently face as a society. It also is crucial to the success of the intensification process.

It involves a delicate balance. Intensification should be carried through in such a way that property values within a neighborhood are supported. Otherwise, there would be strong resistance to change from existing residents. On the other hand, rapidly rising land prices should also be avoided lest the cost of new housing be less competitive. Artificially higher costs for housing within intensification projects are environmentally problematic in three critical ways. First, it is price (value per dollar) which drives many buyers to the competing suburban developments of the urban fringe. Second, building environmental quality into denser developments, including energy efficiency and quality public places, may be cut back in a land price squeeze. Third, higher prices in denser developments help to drive up all housing prices and force more and more people to attempt "long commutes" from outlying cities. The offsetting factors are that higher residential energy efficiency and lower transportation costs may help to reduce total living costs within more compact and proximate settings.

Modest density increases, realized, for example, through the creation of accessory apartments, would appear to achieve a good balance. A study commissioned by the Ontario Ministry of Housing (by Ekos Research Associates, cited in a 1988 Ministry pamphlet: *Accessory Apartments: Property Values*) allays some concerns regarding declining values. Negative effects on the value of adjacent houses appear to be absent: "Generally, neighborhood fears about the potentially negative impact of conversion activities are unfounded in reality." Accessory apartments are, in general, affordable housing. (See also Ministry of Municipal Affairs, 1987.)

Intensification through infilling, redevelopment, and conversions such as accessory apartments can create a wide range of housing types. In particular, intensification can increase the supply of smaller, cheaper accommodation (both sale and rental) to serve sectors of the population that do not need large single-family homes and cannot afford them. The development of a wider range of housing types may enhance community stability. The same neighborhood will be able to accommodate young single people, small families, big families, and "empty nesters". People can change their *residence* as need dictates without having to abandon their *home* or neighborhood.

However, intensification as such will not necessarily generate the desired range of housing types. In a worst case scenario, existing housing for low-income people might be redeveloped to make way for exclusive condominiums. Intensification must be contained within broader housing, social and environmental policies that ensure that housing needs are served through the inclusion of affordable housing and social housing. Zoning could discourage the replacement of existing small houses with larger single-family homes on the same land. Inclusionary zoning, as distinct from exclusionary zoning could encourage increased densities (units per hectare) in carefully selected locations. Traditional exclusionary zoning excludes

high-density, multiple-family, manufactured, or other forms of housing. Inclusionary zoning seeks housing diversity and intelligently mixed land uses (Knaap, 1990).

Finally here, one interesting approach to achieving affordable housing—especially in the long term—is to establish community land trusts (CLTs). CLTs are community-based, non-profit corporations with open (geographically-based) memberships and democratically elected boards of trustees. They acquire and lease land. Funding (sometimes in the form of land) comes from government, foundations, pension funds, churches, and investors seeking a secure return. Buyers purchase housing, but lease the land from the trust. Appreciation in the value of housing is limited to a set maximum (improvements to property plus a fair return). Land remains in the hands of the trust. Some trusts own housing as well. Some housing has been supplied to community trusts by developers as a condition of the opportunity to develop higher priced units in particularly select locations (e.g. waterfront lands). Thus housing is more affordable in the short term because land costs are excluded from purchase price and in the long term because the owner's share of appreciation is explicitly limited. (See Burlington Community Land Trust, 1988.)

Privacy and safety

Privacy and safety are central concerns of people wherever they live, but especially perhaps among residents of low-density suburbs. These people may see any form of land-use intensification as an assault on their protected (and often class-exclusive) enclave of single-family homes. To some extent this conflict is unavoidable. Land-use intensification concentrates more people, a greater variety of people, and more activity in a given area. Those who shun contact with other human beings outside their immediate family and adjacent neighbours may well be uncomfortable with higher densities. However, more compact buildings and communities can be designed to maximize both privacy and safety. It is arguable as well that the greater anonymity of urban living grants more real privacy than the small physical separations of suburbs or small towns.

It is very important to note that rates of crime and many other social ills are not a function of either urban density or overall city size. As Bourne (1976) put it: "There is little evidence that the size of a city is strongly correlated with any of our major policy problems, at least not on a statistically significant basis. There are both large and small cities in Canada which are ugly, polluted, congested, costly-to-live-in and saddled with serious social problems" (p. 10). Neither the causes of, nor the cures for, most risks to individual safety lies necessarily in more or less density, or in bigger or smaller cities. Both the causes and cures must be dealt with more directly—

through full employment, as well as improved education, social services, law enforcement, and criminal justice. Canada as a whole, it might also be observed, is remarkably safe, from its urban cores to its isolated farms and most assaults are by people known to each other, not strangers.

There is a complex relationship between safety, privacy, crime, street activity, and a sense of community. Jane Jacobs observed many years ago that in urban areas safety can be improved by visibility and activity. As well, a private courtyard, accessible to building residents only (wherein residents know each other), and visible to all, is safer still. Some recent studies (noted in Michelson, 1983) suggest that businesses which attract large numbers of strangers to neighborhoods can create a level of anonymity which permits the possibility of crime. He suggests a separation (in design) between public and private spaces. Those private spaces can be both personal and collective (shared by known neighbors and friends). The greatest risks probably exist in locations which are both anonymous and relatively unobserved—districts in the evening which are exclusively oriented to 9-to-5 activities, underground parking garages in the evening, underlit, unobserved, low-use open spaces, and so forth. Additional research on the relationship between design and safety, and design in relation to the sense of privacy or crowding, is needed.

Both the perception and the reality of privacy and safety are closely related to the sense of community. Residents naturally fear that a new residential development will undermine the existing local community. They can feel invaded. Thus, a key to addressing concerns about privacy and safety is the direct involvement of residents in the planning process from the earliest stages. The community must be able to exercise genuine control over the shape of the new development in order to assure that the community continues to "work". The sense of community can be enhanced rather than threatened if the process of development is participatory rather than seemingly imposed.

Particularly critical to safety, and the perception of safety, are safe play spaces for children. Spaces must be created which are away from traffic yet visible from or at least very near to residences. Studies in Britain (Preston, 1990) have shown that social class is a strong determinant of the likelihood of death or injury in pedestrian-vehicle accidents. Poorer children, in some neighborhoods, must play on the streets, indoors, or far from home. In Europe, some smaller streets have been declared play zones. Access is restricted to local traffic moving at walking speeds. But redevelopment should allow for even more creative options. Design for safety should also emphasize the needs and concerns of women, the elderly, and the disabled.

Social services

Intensification can create a need for new or expanded social services (including schools and recreational facilities) to ensure that the change results in a net benefit to the community. More people will require more services. But intensification may also introduce a shift in the *kinds* of services that are needed, for example, where there is an influx of seniors or single-parent families.

The impact on social, educational, and recreational services should be formally assessed as part of the municipal land-use approval process. It may be appropriate to incorporate certain facilities within intensification projects themselves, such as a daycare centre, a seniors' facility, or a practice room for aspiring young musicians. The host community must also be involved in assessing social impacts and addressing them. In addition, the impact on social services must be carefully re-assessed *after* a project has been completed and inhabited, since it is not always possible to anticipate the mix of residents and their needs ahead of time.

10. CONCLUSION: TOWARD SUSTAINABLE URBAN DEVELOPMENT

PATTERNS of urban development can only be changed over the course of several decades, and sustainable urban forms will not develop on their own. At the same time, global environmental concerns dictate to us the need for substantial changes in the patterns of our everyday largely urbanized lives—where we live in relation to where we work and recreate, what kinds of dwellings we live in, etc. Land-use intensification which addresses these basic issues has been proposed as part of a strategy to approach sustainable urban development.

The urban form can only be altered qualitatively over the course of several decades. By then, the world will be a very different place. Our planning must anticipate the ways in which it will be different. Contemporary environmental concerns indicate many of the paths that change must follow. We can no longer ignore these concerns. We must learn to take the needs of future generations into account. Sustainable urban forms will not develop on their own. There is thus an urgent need to understand those forms, to anticipate future needs, and to move our cities in the right direction as quickly as we can.

This report has reviewed the positive and negative environmental implications of land-use intensification. The conclusion is that the positive implications significantly outweigh the negative ones, especially when opportunities concurrent to intensification projects are maximized and the existing risks are reduced or mitigated. Further study is needed, especially on how to reduce our excessive automobile dependence, on how to design and create more compact neighborhoods which are seen as preferable to lower density settings, and how to effectively integrate new housing forms into existing neighborhoods and communities.

The transition to more sustainable urban forms will require major innovation, reform and participation from many sectors of our society, particularly housing developers, public officials, and an informed and involved public. While several of the design challenges are elaborated here, the

challenges to public policy—which are varied and substantial—are beyond the scope of this report.

The importance and urgency of altering the contemporary urban form cannot be overestimated. Canadians overwhelmingly live in cities, but our cities are not, in their present form, sustainable. Even modest caution would suggest that change should begin now. More compact cities *can* be places where people want to be. Proper design and planning can create cities which meet the needs of people within the means which nature offers.

APPENDIX 1: TABLES AND FIGURES

Table 1: URBAN DENSITY AND GASOLINE CONSUMPTION IN MAJOR CITIES, 1980

City	Gasoline Consumption Per Person (MegaJoules)	Overall Populat'n Density (People per hectare)	Inner City Populat'n Density (People per hectare)	Overall Job Density (Jobs per hectare)	Inner City Job Density (Jobs per hectare)	Private Automobile Travel Per Person (Kilometres)
*American Cities**	58,541	14	45	7	30	12,507
San Francisco	55,365	16	59	8	48	13,200
Chicago	48,246	18	54	8	26	11,122
*Australian Cities**	29,849	14	24	6	27	10,680
Melbourne	29,104	16	29	6	40	10,128
Sydney	27,986	18	39	8	39	9,450
Metro Toronto	*34,813*	*40*	*57*	*20*	*38*	*9,850*
*European Cities**	13,280	54	91	31	79	5,595
Frankfurt	16,093	54	63	43	74	6,810
Stockholm	15,574	51	58	34	62	6,570
Paris	14,091	48	106	22	60	4,199
*Asian Cities**	5,493	160	464	71	296	1,799

* Note that the figures given for American, Australian, European and Asian cities in the table are averages for the cities in those regions studied by Newman and Kenworthy. The data reflect results from 10 American, 5 Australian and 12 European cities. The Asian data are for the 3 'westernized' Asian cities of Tokyo, Singapore and Hong Kong.

Source: Based on Canadian Urban Institute, *Housing Intensification: Policies, Constraints and Challenges* (Toronto: Canadian Urban Institute, 1990), pg. 13. Compiled from material originally presented in Peter Newman and Jeffrey Kenworthy, *Cities and Automobile Dependence: An International Sourcebook* (Hants, England: Gower Publishing, 1989).

Interpretation:

The extent to which people choose to use private passenger cars is a direct function of urban density. Cities which are more compact are significantly less dependent on automobiles. Residents of U.S. cities drive their cars, on average, two to three times as far as do residents of European cities. Toronto is about mid-way between a typical American and a typical European city in this regard.

Table II:
URBAN COMPARISONS:
POPULATION, DENSITY AND MODES OF TRANSPORTATION

Metropolitan Areas	Population	Urban Density (People per km^2.)	Total Vehicles Per 1000 People	% of Trips to Work by Public Transit	% of Trips to Work by Cycling and Walking
American Cities					
Los Angeles	12,000,000	2,000	667	7.7%	4.2%
San Francisco	5,731,400	1,550	681	17.0%	5.5%
Chicago	8,116,000	1,750	518	18.3%	6.2%
GTA (Urban Area)	*4,000,000*	*2,700*	*n/a*	*25.0%*	*10.0%*
Metro Toronto	*2,200,000*	*3,500*	*554*	*33.3%*	*10.0%*
European Cities					
London	6,800,000	5,630	356	39.0%	23.0%
Munich	2,315,899	5,690	398	42.0%	20.0%
Paris	8,500,000	4,830	383	39.8%	23.8%
Asian Cities					
Singapore	2,586,000	8,320	115	59.6%	15.8%
Hong Kong	5,396,000	29,330	66	62.2%	34.5%

Source: Metropolitan Toronto Planning Department, *The GTA: Concepts for the Future* (Toronto: 1990). Original sources include: Data Management Group, *Transportation Tomorrow Survey: Travel Survey Summary for the GTA*, Toronto, June 1989; Institut D'Estudis Metropolitans de Barcelona, *Cities: Statistical, Administrative and Graphical Information*, Barcelona, 1988; and Peter Newman and Jeffrey Kenworthy, *Cities and Automobile Dependence: An International Sourcebook* (Hants, England: Gower Publishing, 1989).

Interpretation:

Walking, cycling and public transit are the predominant means of transportation within most European and Asian cities, even the most prosperous ones. Toronto is significantly better in this regard than are typical U.S. cities, but the comparison with Europe is perhaps even more striking. Also notable is the fact that public transit is much more heavily utilized within Metro than within regions which surround it. Finally here, it might be observed that a good proportion of Toronto households own autos, but do not use them for the trip to work.

Table III:
ENERGY REQUIREMENTS OF DIFFERENT URBAN TRAVEL MODES

Travel Mode	Average Number of Persons Carried	Energy Used per Passenger Mile (MegaJoules)	Energy Used per Passenger Mile if Fully Laden (MegaJoules)
Automobile			
Engine under 1.4 litres	1.3	3.22	1.05
Engine 1.4 - 2.0 litres	1.3	3.70	1.20
Engine over 2.0 litres	1.3	5.72	1.86
Motorcycle	1.2	3.13	1.88
Moped	1	1.31	1.31
Rail-based			
Diesel	88 (60% full)	0.89	0.53
Electric	180 (60% full)	0.70	0.42
Bus	16 (33% full)	1.40	0.47
Walking	(1)	0.25	0.25
Bicycle	1	0.10	0.10

Source: Based on Peter Hughes, "How Green is My Maestro," *Town and Country Planning*, Vol. 50, No. 1, Jan. 1990, pg. 23. Automobile data have been adjusted for Canadian loading factors. Original source: P. Hughes, *A Preliminary Evaluation of Options to Reduce CO_2 Emissions in the UK Transport Sector*, EERU Report, Open University, Milton Keynes, 1990.

Table IV:
POPULATION GROWTH AND LAND CONVERSION IN CANADA'S URBAN-CENTRED REGIONS, 1981-1986

Population Range	Population Density (People per hectare)	Population Increase, 1981-86 (Percent)	Increase in Urban Area 1981-86 (Percent)	Rate of Land Conversion (Hectares per additional 1,000 people)
25,000 - 50,000	9.0	1.5%	3.3%	242
50,001 - 100,000	9.8	2.9%	4.0%	141
100,001 - 250,000	12.8	3.6%	4.9%	104
250,000 - 500,000	12.4	5.2%	3.2%	50
More than 500,000	19.5	6.3%	6.6%	53

Source: Based on Environment Canada, *Urbanization of Rural Land in Canada, 1981-1986* (State of the Environment Fact Sheet No. 89-1), pg. 4.

Interpretation:

On average, larger cities use less land per person than do smaller cities. More important perhaps, when they add population cities of over 250,000 use less than one half the land that would be used to add the same population within a city of 100,000 - 250,000. They use less than one quarter the land that would be used in cities of 25,000 - 50,000.

Table V:
ADDITIONAL DATA ON AIR QUALITY AND AUTO EMISSIONS

EACH PERSON USING MASS TRANSIT FOR A YEAR INSTEAD OF USING THEIR AUTOMOBILE SAVES THE ATMOSPHERE, ON AVERAGE, ABOUT:

- **13.5 kilograms of hydrocarbons** (roughly equal in weight to the amount of pure air that each of us needs each day to survive);
- **99.5 kilograms of carbon monoxide** (more than twice the amount required to bring the level of carbon monoxide in a domed stadium to dangerous conditions);
- **1,517 kilograms of carbon dioxide** (20% of the amount removed by one hectare of forest);
- **7.0 kilograms of nitrogen oxides** (more than three times the amount required to bring the level of carbon monoxide in a domed stadium to dangerous conditions);
- **0.14 kilograms of sulphur oxides** (enough to produce a volume of acid rain equal to the water in twenty Olympic-size swimming pools);
- **0.12 kilograms of particulate matter** (about equal to a coffee cup filled with potentially poisonous or disease-producing particles, e.g. lead, arsenic, aldehydes).

Source: City of Vancouver, *Clouds of Change* (Vancouver, June 1990), pp. 33, 40. Original source: Trans-Vision Consultants, *Transit and the Environment* (Vancouver: B.C. Transit, April 1990).

Table VI:
THE EFFECT OF WORKPLACE PARKING SUBSIDIES ON EMPLOYEE DRIVING HABITS

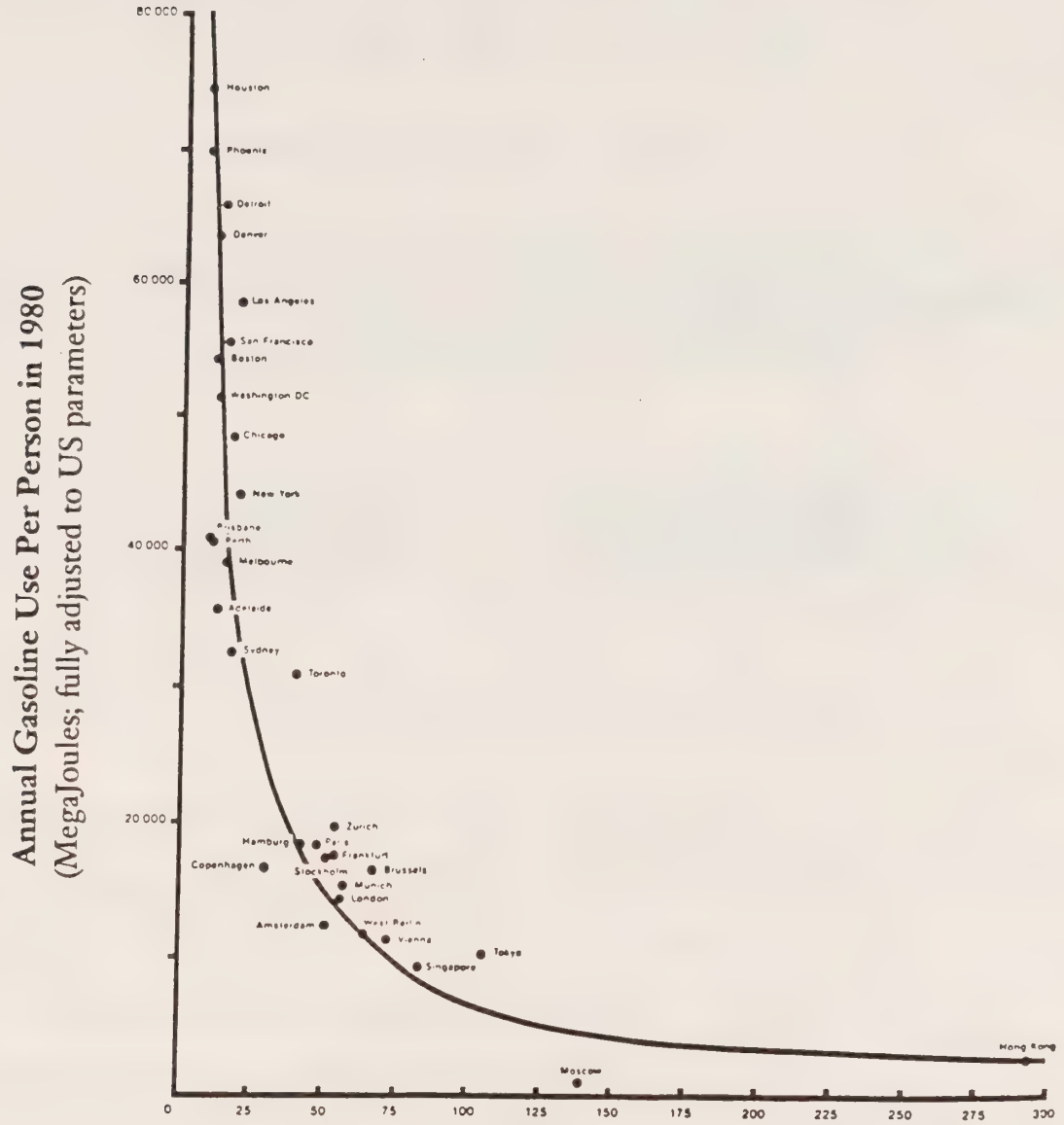
Community	% of Employees Driving to Work Solo		Decrease in Solo Driving (Percent)
	Employer Pays For Parking	Driver Pays For Parking	
Mid Wilshire, Los Angeles (1984)	42%	8%	–81%
Warner Center, Los Angeles (1989)	90%	46%	–49%
Century City, Los Angeles (1976)	92%	75%	–19%
Civic Center, Los Angeles (1969)	72%	40%	–44%
Downtown Ottawa, Ontario (1978)	35%	28%	–20%
Average of above studies	**66%**	**39%**	**–41%**

Community	Cars Driven to Work per 100 Employees		Decrease in Auto Trips (Percent)
	Employer Pays For Parking	Driver Pays For Parking	
Mid Wilshire, Los Angeles (1984)	48	30	–38%
Warner Center, Los Angeles (1989)	92	64	–30%
Century City, Los Angeles (1976)	94	80	–15%
Civic Center, Los Angeles (1969)	78	50	–36%
Downtown Ottawa, Ontario (1978)	39	32	–18%
Average of above studies	**70**	**51**	**–27%**

Note: The Mid Wilshire, Warner Center and Ottawa studies compared the same employees before and after elimination of subsidized workplace parking. The Century City and Civic Center studies compared matched groups of employees in the same location, one with and one without subsidized parking.

Source: Richard W. Willson and Donald C. Shoup, "Parking Subsidies and Travel Choices: Assessing the Evidence," *Transportation: An International Journal Devoted to the Improvement of Transportation Planning and Practice*, 17 (2):141-157 (1990).

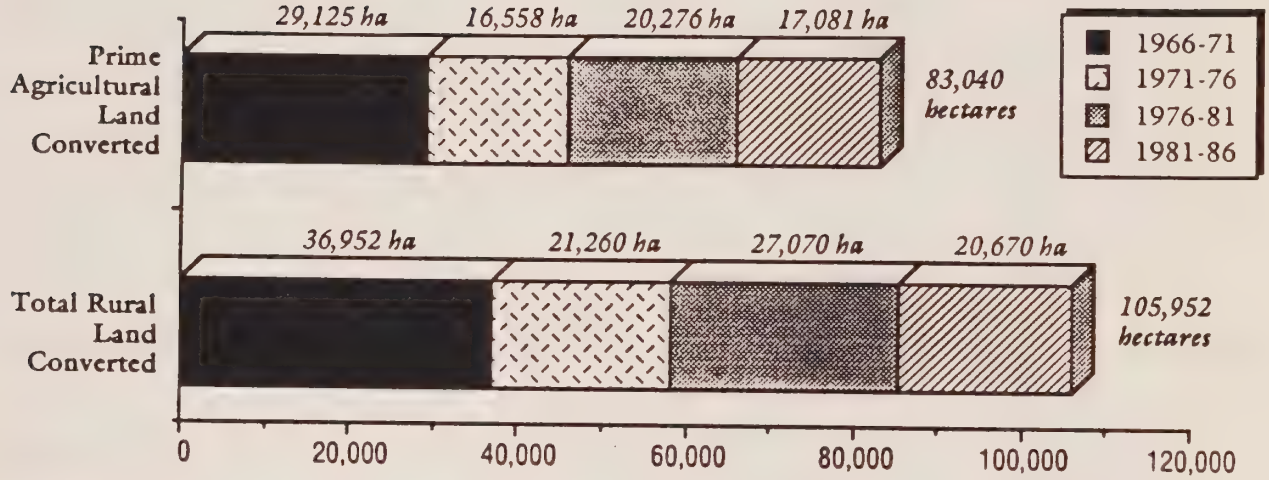
Figure I:
GASOLINE CONSUMPTION AND URBAN DENSITY IN MAJOR WORLD CITIES, 1980



Note: Figures for all cities have been adjusted to US income, vehicle efficiency and gasoline prices.

Source: Peter Newman and Jeffrey Kenworthy, *Cities and Automobile Dependence: An International Sourcebook* (Hants, England: Gower Publishing, 1989), Figure 5.7, pg. 128.

Figure II:
CONVERSION OF RURAL LAND AND PRIME AGRICULTURAL LAND TO URBAN USES IN ONTARIO'S URBAN-CENTRED REGIONS, 1966-1986



Rural Land Converted to Urban Uses in Ontario, 1966-1986 (hectares)

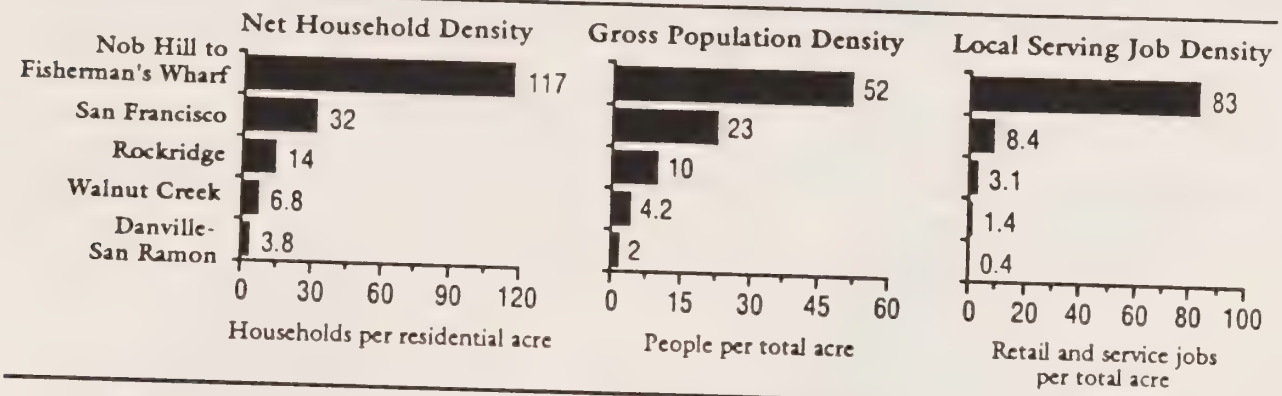
Source: Based on data from Environment Canada, *Urbanization of Rural Land in Canada, 1981-1986* (State of the Environment Fact Sheet No. 89-1), pg. 9.

Interpretation:

Over the 20 years from 1966 to 1986 Ontario urbanized 105,952 hectares of rural land, considerably more than any other province and 35% of the Canadian total. 78% of that area, or 83,040 hectares, was prime agricultural land (Canada Land Inventory classes 1 to 3). Environment Canada reports that land conversion parallels economic conditions. During periods of prosperity, large amounts of rural land are urbanized. Less conversion occurs during economic slowdowns. It is likely that a large amount of Ontario land was converted to urban uses between 1986 and 1991.

Figure III:
THE RELATIONSHIP OF URBAN DENSITY TO AUTOMOBILE USE, GASOLINE USE, AUTO EMISSIONS AND DRIVING COSTS IN THE SAN FRANCISCO AREA, 1989

1. Characteristics of the Communities Studied



HOLTZCLAW (1991) STUDIED TRANSPORTATION PATTERNS AND THE ENVIRONMENT IN THE FOLLOWING FIVE COMMUNITIES:

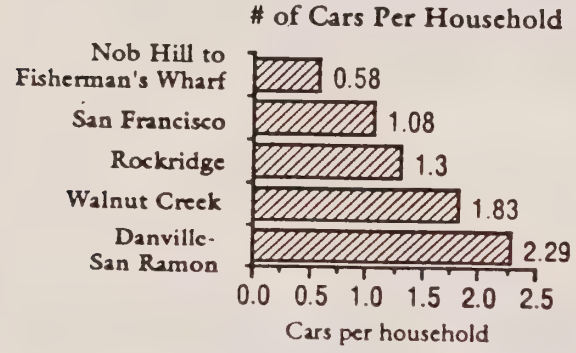
- **Nob Hill to Fisherman's Wharf** (northeast San Francisco; population 55,200)
  - Fairly dense settlement; richly served by neighbourhood business and transit.
- **San Francisco** (population 718,499)
  - Moderate to dense settlement, neighbourhood business and transit service.
- **Rockridge** (north Oakland to south Berkeley; population 52,743)
  - Moderate settlement density, neighbourhood business and transit service.
- **Walnut Creek** (suburban; population 73,732)
  - Low to moderate settlement density, neighbourhood business and bus service, but with two Bay Area Rapid Transit (BART) stations.
- **Danville - San Ramon** (suburban; population 70,770)
  - Low settlement density and neighbourhood business, and little transit service.

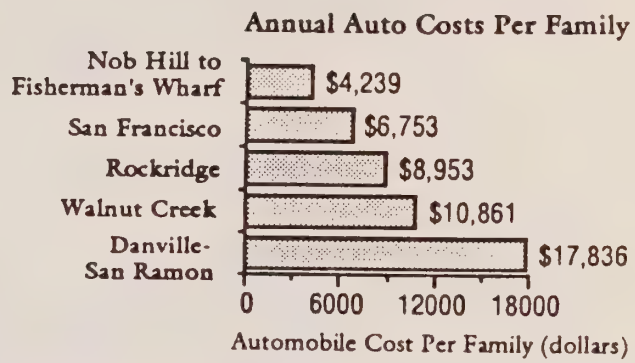
Continued on next page ...

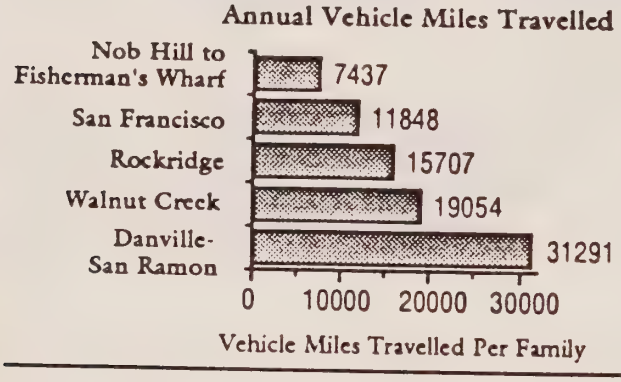
Source: Derived from data in John Holtzclaw, *Explaining Urban Density and Transit Impacts on Auto Use*, Natural Resources Defense Council/Sierra Club, 1991.

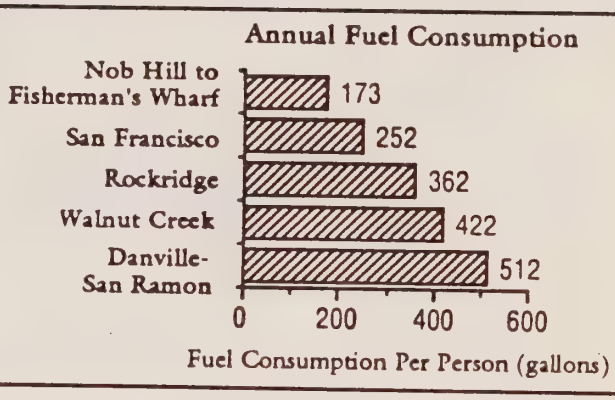
Figure III (cont'd)

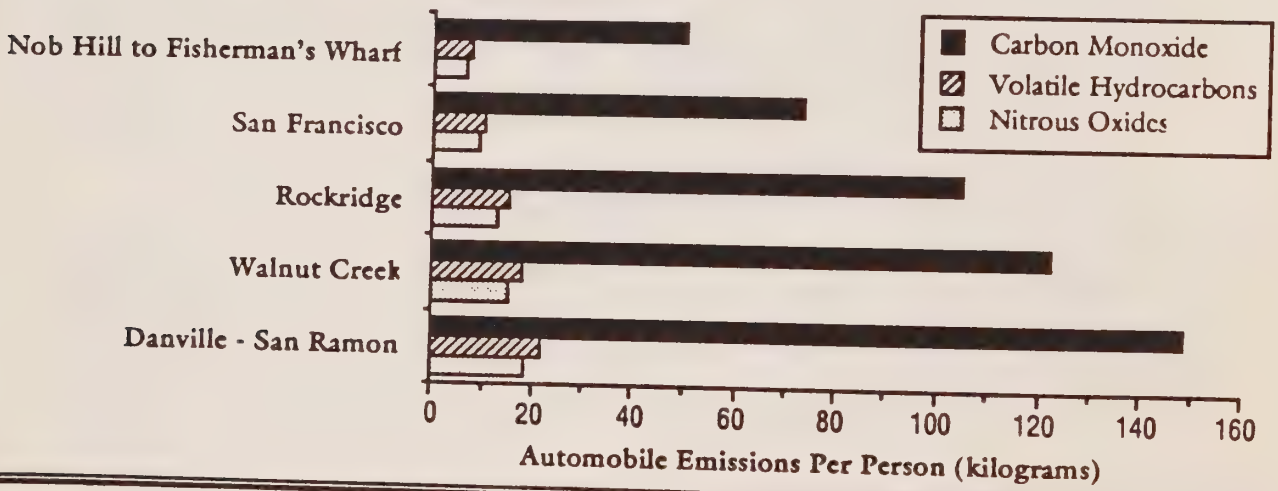
2. Results of the Study







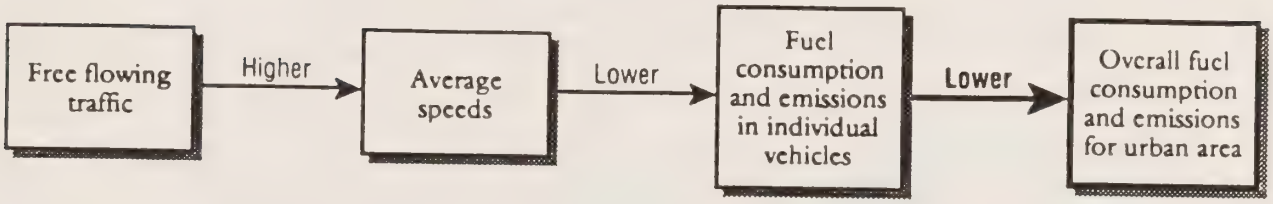




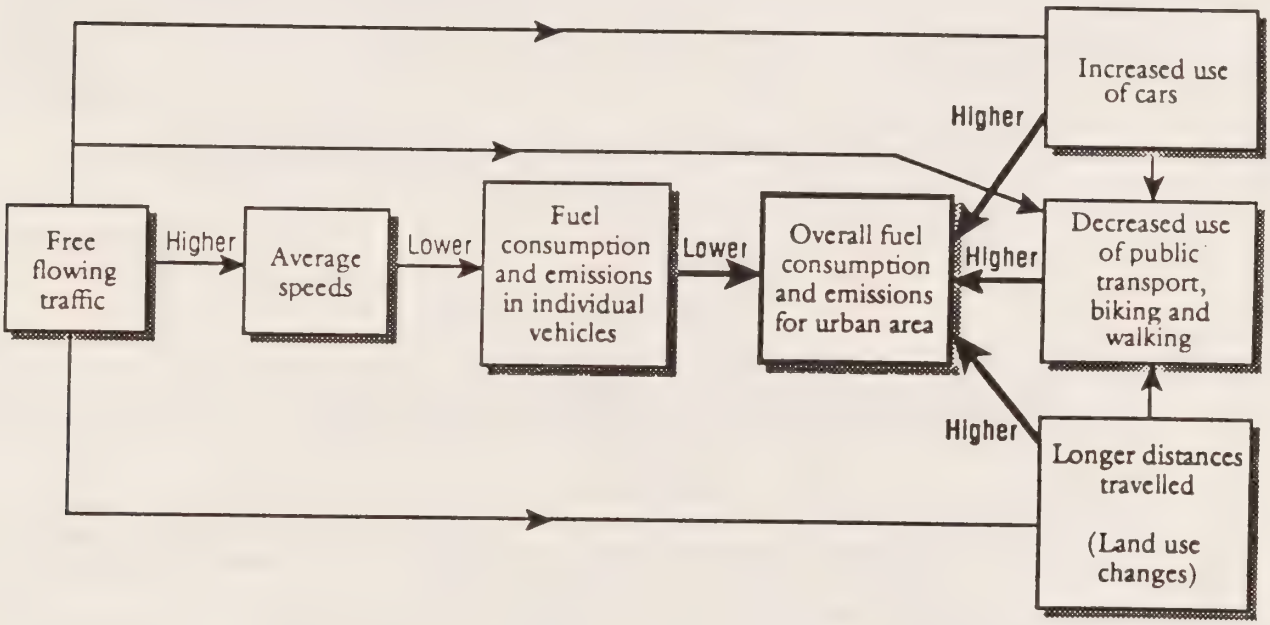
Interpretation:

Holtzclaw's study reveals the very strong relationships between increasing density and decreasing automobile ownership, use, pollution and expense. Annual vehicle miles travelled decrease rapidly as density rises, partly due to proximity to needed services.

Figure IV:
RELATIONSHIPS AMONG CONGESTION, AUTO USE AND THE ENVIRONMENT



MODEL 1: SIMPLE LINEAR ASSUMPTIONS

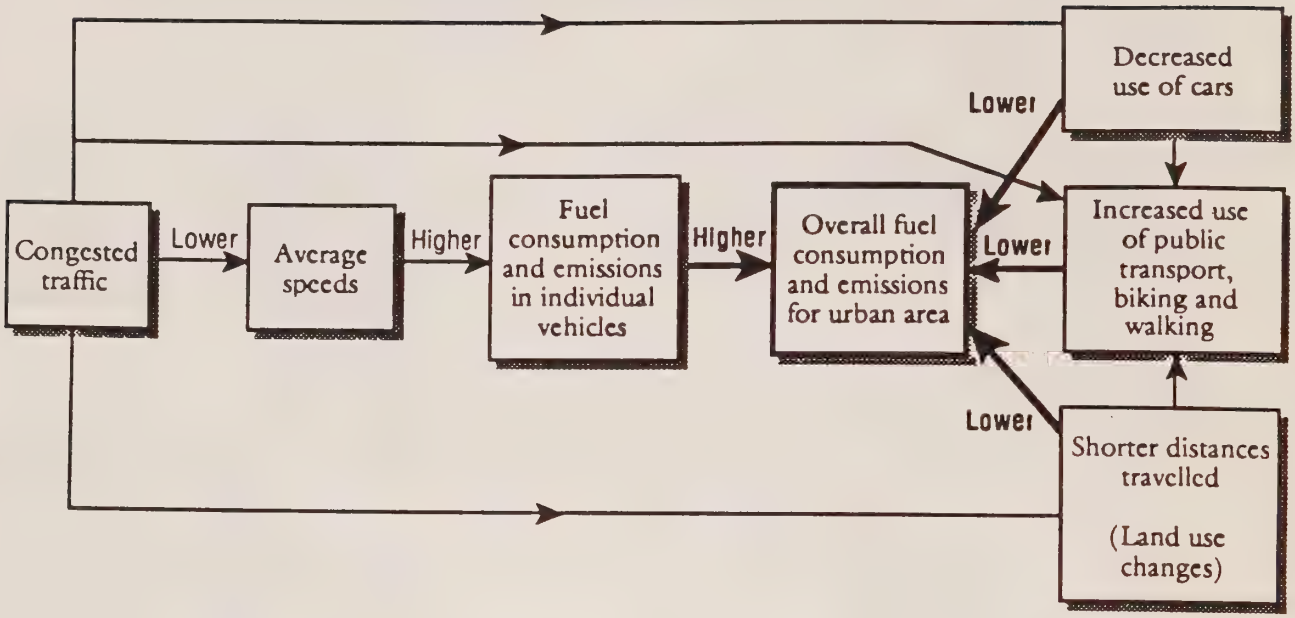


MODEL 2: FEEDBACK ASSUMPTIONS – FREE-FLOWING TRAFFIC

Continued on next page ...

Source: Peter Newman and Jeffrey Kenworthy, *Cities and Automobile Dependence: An International Sourcebook*, pg. 146.

Figure IV (cont'd)



MODEL 3: FEEDBACK ASSUMPTIONS – CONGESTED TRAFFIC

Interpretation:

It is often argued that traffic congestion is a major cause of urban air pollution, since cars use more fuel and generate more emissions in congested traffic than when moving freely. Newman and Kenworthy (1989) argue, however, that while this view may be valid for an individual car, it ignores the feedback effects of congestion on the entire transportation system.

Model 1 (previous page) sets out the assumptions of the traditional model. Free flowing traffic at higher average speeds produces lower fuel consumption in individual vehicles. It is thus assumed that overall fuel consumption and emissions for the system are lower. Transportation managers often present this as an environmental argument for expanding the road network.

Model 2 (previous page), however, factors in the feedback effects of freely moving automobile traffic. While higher speeds do tend to lower fuel consumption and emissions, the improvement is more than cancelled out by the incentive clear roads provide for increasing use of cars. This increasing use in turn decreases the market share and viability of public transit. Driving, meanwhile, encourages gradual land-use changes that foster increasing sprawl and longer travel distances.

Model 3 (above) applies these feedback assumptions to congested traffic to show that it encourages less driving, more use of public transit and helpful land use changes. Newman and Kenworthy conclude that "free flowing traffic does not lead to savings in fuel or lowering of emissions," and that "the central focus needs to be on automobile dependence rather than any tinkering with how well a vehicle is performing in the traffic stream." (p. 160)

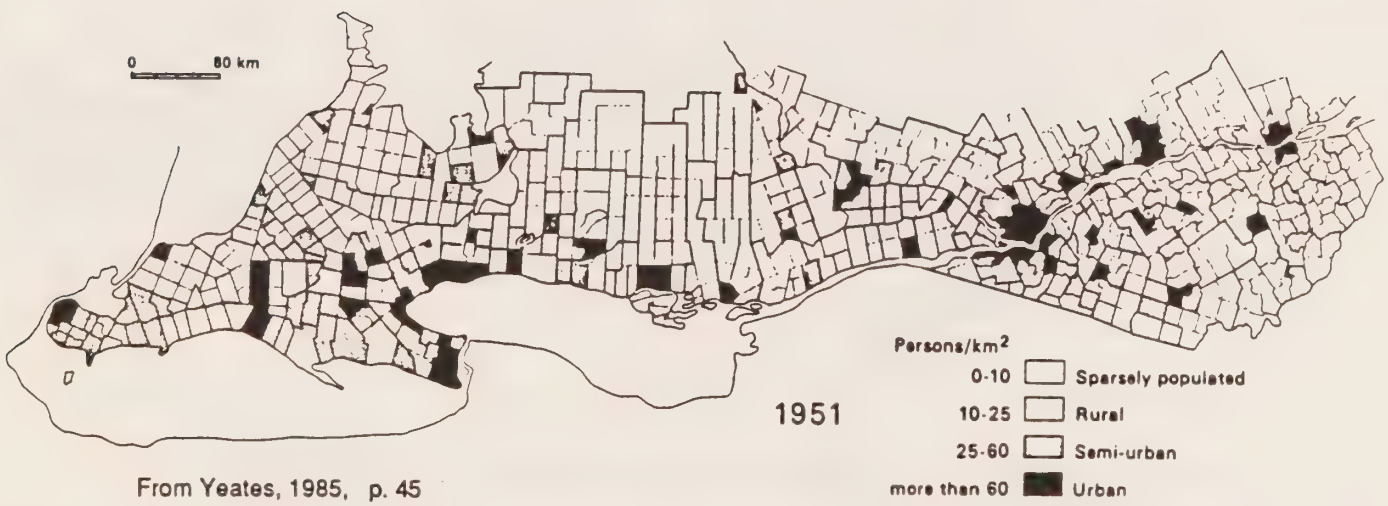
Figure V:
THE URBANIZATION OF SOUTHERN ONTARIO

Map 1

Areas Defined as Urban, Semi-Urban, Rural, and Sparsely Populated in the Windsor-Québec Axis, 1921

Map 2

Areas Defined as Urban, Semi-Urban, Rural, and Sparsely Populated in the Windsor-Québec Axis, 1951

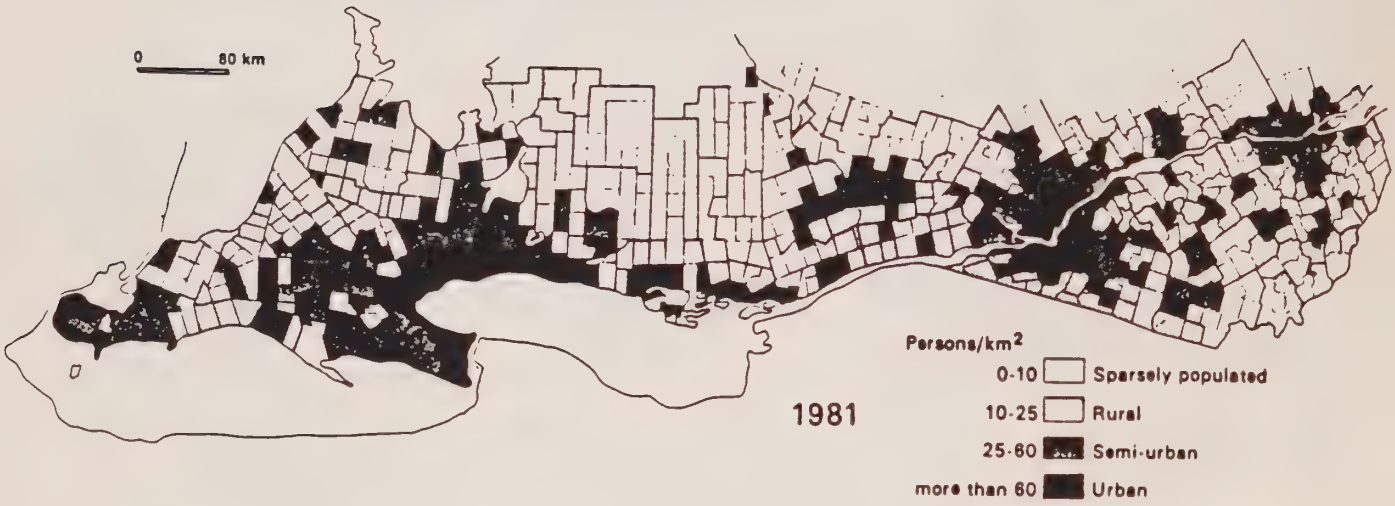


From Yeates, 1985, p. 45

Figure V cont'd

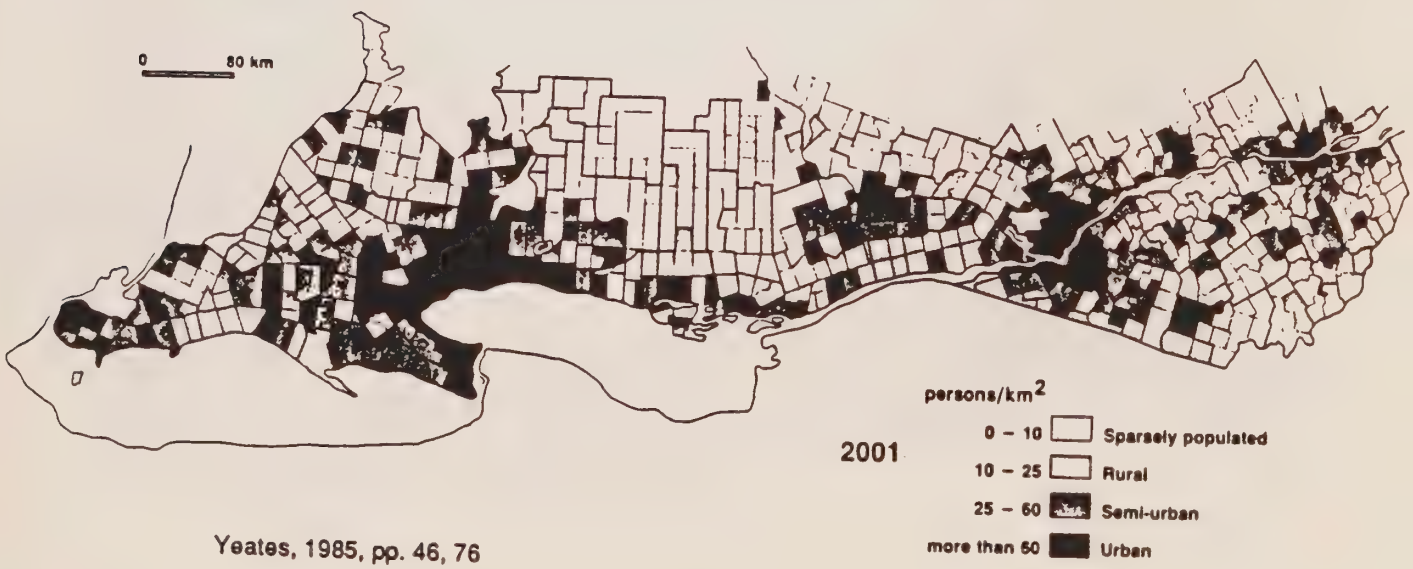
Map 3

Areas Defined as Urban, Semi-Urban, Rural, and Sparsely Populated
in the Windsor-Québec Axis, 1981



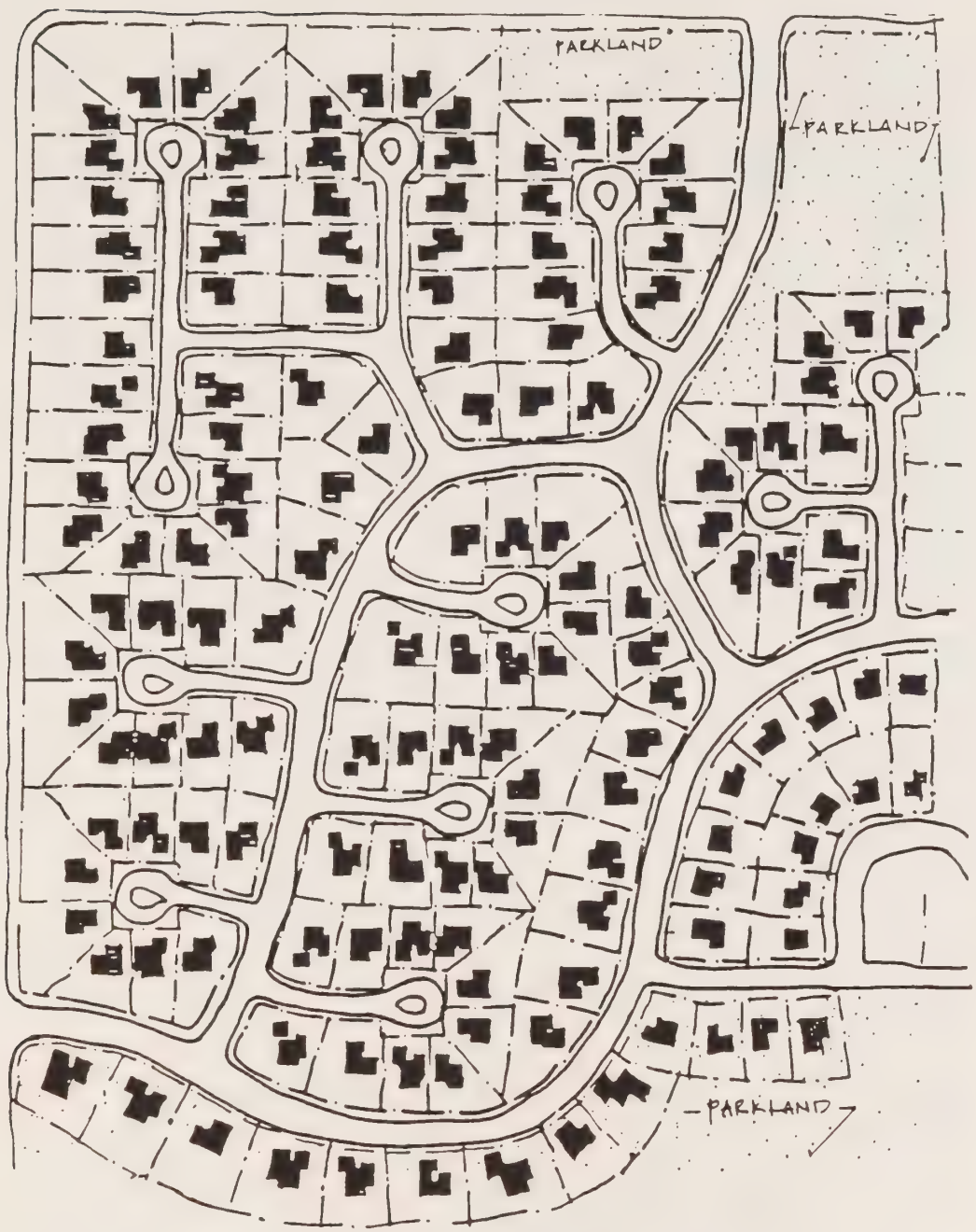
Map 4

Areas Defined as Urban, Semi-Urban, Rural and Sparsely Populated
in the Windsor-Québec Axis, 2001



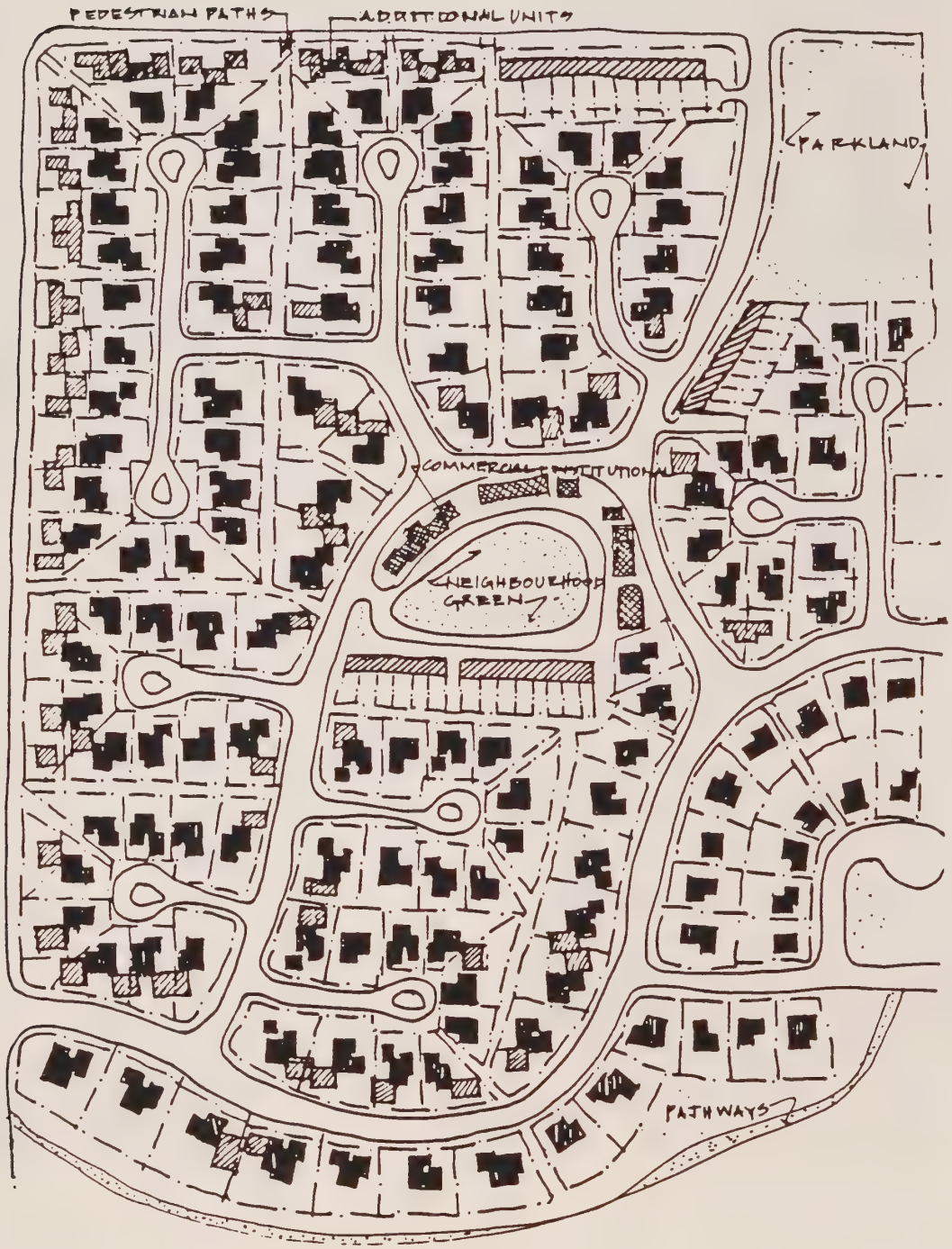
Yeates, 1985, pp. 46, 76

Figure VI:
CONVENTIONAL SUBDIVISION



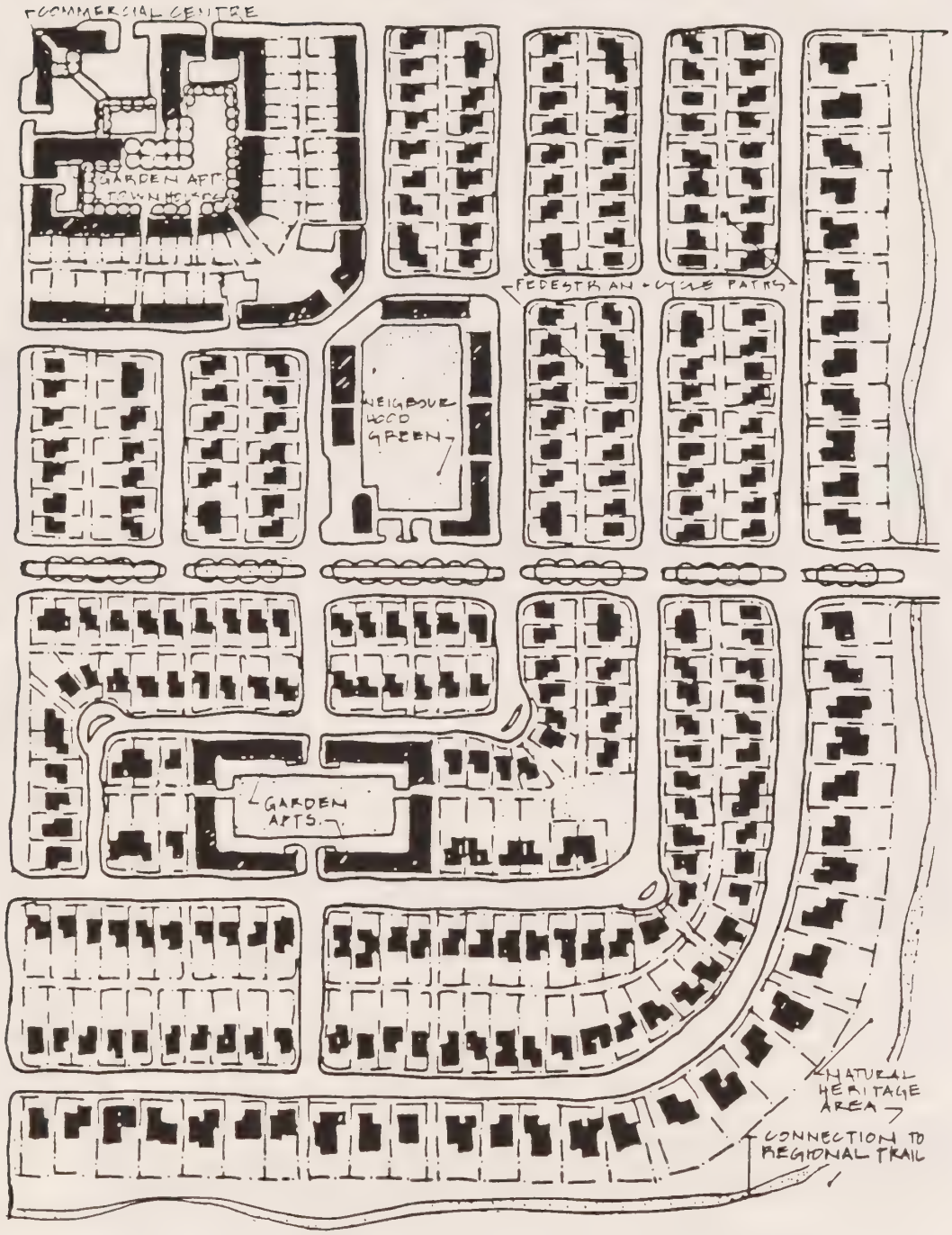
Conventional subdivision: 2.3 units/acre gross, 7 % parkland. 65 acres, 151 units. Single family dwellings. L.J. Kelly.

Figure VII:
INTENSIFIED
CONVENTIONAL SUBDIVISION



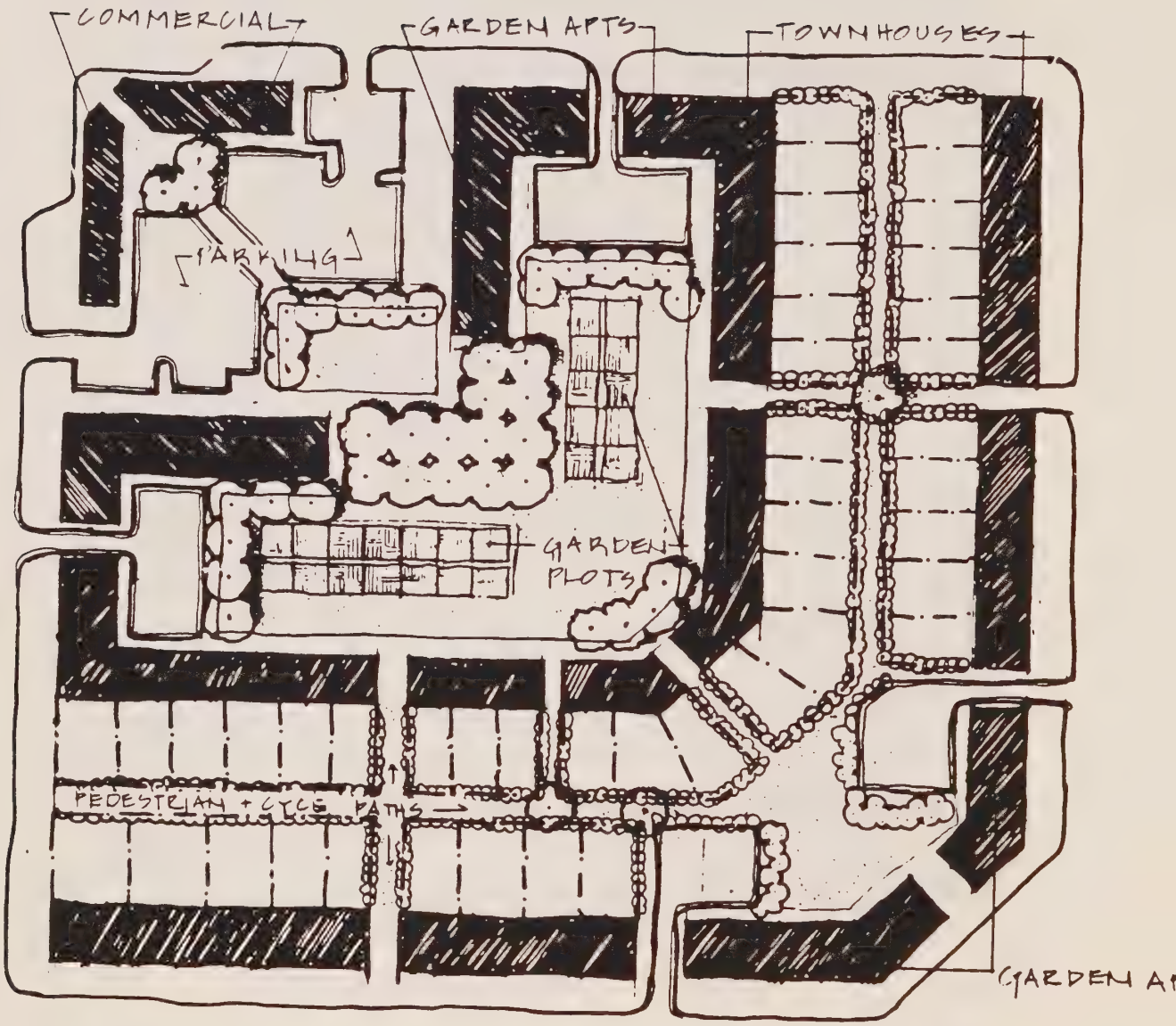
Conventional subdivision, intensified using easements for walkways and flexible lot severance restrictions. 4.1 units/acre gross. L.J. Kelly.

Figure VIII:
ALTERNATIVE TRADITIONAL NEIGHBOURHOOD



Altnernative traditional-styled urban neighbourhood. 7 units/acre. 5% parkland/pathways. 65 acres. 455 units. Includes rental (garden apartments), townhouses, semi-detached, single-family dwellings, commercial and institutional. L.J. Kelly.

Figure IX:
DETAIL OF INTENSIVE AREA



Detail of intensive area from Figure VIII, alternative traditional-style urban neighbourhood. L.J. Kelly.

APPENDIX 2: INTEGRATING THE CRITERIA FOR ENVIRONMENTAL DECISION-MAKING

SECTION 2 discussed the principle factors by which one can decide the extent to which urban intensification (or any other action) is, or is not, "environmentally appropriate". In the broadest terms these are the criteria by which we measure resource sustainability and environmental impacts. Environmental impacts are, in a sense, inclusive of all threats to sustainability. The many factors which produce impacts can be subsumed in a unified formula:

$$Im = P \times A \times In \times T$$

Where **Im** is environmental impact, **P** is population, **A** is affluence, In is energy, land and materials intensivity, and **T** is choice of technology. Environmental impacts, in sustainable development terms, are a measure of both resource sustainability and pollution.

This formulation incorporates and integrates the thinking of such diverse environmental analysts as Amory Lovins, Paul Ehrlich, Barry Commoner, Kenneth Boulding, and numerous others. It does not, however, assume that environmental problems are the result of a single, or even a single predominant cause. Nor is there a single or simple solution. But every initiative must be measured in terms of the extent to which it helps to reduce or mitigate either **In** or **T**. One assumes that **P** must stabilize, but that stabilization cannot be imposed by governmental policy. One assumes that **A** may in fact be restrained within the process of sustainable development, but that slow (or no) economic growth is not an objective of governmental policy.

Clearly, though, the various factors in the formula are related to one another in a multiplicative way. Ten wealthy North Americans will, on

average, create the environmental impacts of 100 or 1000 residents of the Third World, so long as the intensity of consumption and the impacts associated with choice of technology are held constant. Affluence here is stated in terms of GNP/capita. But that GNP can be comprised predominantly of inherently quite benign products (education, human services, or financial or legal services), or it can be produced using relatively benign technologies (organically grown food products, recycled containers, or solar energy). Each set of variables multiples the impacts of meeting a given level of prosperity needs of a given number of people.

Intensity (In) has at least three significant dimensions. Kenneth Boulding's phrase "energy and material throughputs" captures two of these. The Science Council of Canada, when it called for doing more with less, captured all three. The three components of In are energy (Ini), materials (Inii), and land (Iniii). Ini is probably the most important of the three. It may be the most significant single factor in the equation as a whole. This is why this report has, for example, emphasized transportation factors. But urban intensification can lead to significant efficiency improvements in the use of all three resource factors: energy, materials and land. Energy intensity can be calculated and expressed in terms of, for example, metric tonnes of coal equivalent per dollar of GNP (MTCE/$GNP). Materials intensity can be expressed in tonnes per dollar of GNP; land intensity in terms of urbanized hectares per dollar of GNP.

Efficient land use is fundamental to environmental protection. This has been understood since the nineteenth century insights of George Perkins Marsh and John Muir. It attained a philosophical/ethical level within the insights of Aldo Leopold in the mid-twentieth century. Even in Canada, one of the least densely populated of all nations, less than 2 per cent of the land mass is prime farmland and less than 2 per cent is fully protected wilderness. Human settlements inevitably have significant impacts on the land: the more compact those settlements the more restrained the impacts. It is within a consideration of all three aspects of In that one can appreciate the fundamental advantages of rail, bus, cycling and walking as against automobile transportation, mixed use as against exclusionary zoning and compact multiple-unit dwellings against single family dwellings on large lots.

Choice of technology (T) is perhaps the most complex of the factors in the overall equation. It is a measure of impacts per unit of output. It alone must almost always be expressed in probabilistic terms. A determination of the value of this factor would incorporate calculations based on the literatures of both technology assessment and risk assessment. Within the calculation of this factor, "trade-offs" are inevitable. Nuclear power may avoid SO_2 and CO_2 emissions (as well as allow reduced Iniii impacts), but it carries its own special set of problems. The problems are not necessarily directly comparable (an apples versus oranges problem). Not only are they irretrievably probabilistic, but neither the risks, nor the probabilities, will ever

likely be fully determined with a widespread sense of confidence. (The same, of course, might be said about the greenhouse effect, at least until such time as the greenhouse outcomes are spectacularly negative.) More than that, in the case of nuclear power (and, again, the greenhouse effect) it will be argued by some that since the potential negative consequences approach the infinite the risks are unacceptable regardless of how remote the probabilities of the worst-case scenario. One partial, but only partial, means of distinguishing among seemingly non-comparable T factors lies in a determination of relative ecological (and socio-economic) reversibility. Needless to say, reversibility itself cannot be anticipated with certainty.

For these and other reasons, no formula can ever in and of itself fully establish environmental priorities. This is not an argument against proceeding with further formula development, nor with formula-based calculations. It is an argument against waiting for the comfort of scientific certainties before taking politically and economically difficult decisions. Environmental decision-making requires both practical intelligence and the creative use of all policy, political, and legal-institutional possibilities. Urban intensification is a policy option which, in combination with improved technologies of many kinds, can significantly reduce total impacts.

APPENDIX 3: ANNOTED BIBLIOGRAPHY ON INTENSIFICATION

Access to Transportation in Our Neighbourhoods, et al. *Greening Ontario's Transportation: A Public Campaign.* Toronto, June 1990. A joint report by seven Ontario environmental groups. Outlines air quality impact of automobile use in the GTA. Target of reducing automobile use 50 per cent by the year 2000 from the base year of 1990. Reduce highway construction. Decommission the Gardiner. Cut regional GO transit expansion. Intensification vs. sprawl. Change the *Planning Act* to integrate transportation planning and land-use planning. Outlines several scenarios for auto use and air quality.

Allen, Greg et al. *Greenlands: A Sustainable Development Plan. Toronto's Waterfront Railway Lands.* Toronto, October, 1990. Contains recommendations for designing an environmentally appropriate mixed-use infill project with state-of-the-art energy efficiency standards, landscaping for natural filtering of storm water, maximum water conservation, solar aquatics for on-site sewage treatment, zero discharge of toxic wastes, and pedestrian- and bicycle-based transportation.

Armour, Audrey. "Integrating Impact Assessment in the Planning Process—From Rhetoric to Reality." *Impact Assessment Bulletin,* 8, 1 and 2 (1990). How assessment can help implement sustainable development by continually monitoring, re-framing, and evaluating throughout the planning process. Rather than simple "before and after" assessment, the paper advocates assessment at all stages of planning, from goal definition through policy and programme, to project and post-project stages. Attempts conceptual integration of assessment into planning rather than more nuts-and-bolts functional integration.

Baerwaldt, Wayne and Barton Reid. "Re-reading Suburbia." *City Magazine* (Winter 1986): 17-29. A condensed economic history of the automobile suburbs, outlining changes in supply and demand factors affecting the suburbs. Foresees urbanization of suburbia.

Baumgartner, M.P. *The Moral Order of a Suburb.* New York: Oxford, 1988. An anthropologist examines the "moral minimalism of the suburbs". "It is even possible to speak of the suburb as a culture of avoidance" in which conflict is resolved through "a curtailment of interaction with a person whose behavior is offensive." Suburbs are distinguished by the relative absence of strangers.

Berry, Brian J. L., et al. *Land Use, Urban Form and Environmental Quality.* Chicago: University of Chicago, Department of Geography, 1974. (For the Office of Research and Development, U.S. Environmental Protection Agency.) A comprehensive early study that is an important (if somewhat dated) reference for research on urban development and the environment. Deals with the ways in which urban form and land-use patterns influence the type and degree of pollution. A great deal of technical data is presented to support the conclusion that core-oriented cities with transportation systems that radiate out from the centre and steep density gradients have a higher land-use intensity, a larger proportion of open space and lower levels of air pollution than dispersed cities with perimeter-oriented transportation and more uniform density.

Boehmer-Christiansen, Sonja. "Curbing Auto Emissions in Europe." *Environment,* 32: 17-20: 34-39. Outlines politics of reducing automobile emis-

sions within the European Community. Discusses tax and subsidy system that contributes to vehicle emission levels. The primary avenue for reduced emissions is seen to be the catalytic converter. The secondary, and more difficult, avenue is reduced automobile use. In Zurich, advertising has made it a public virtue for professionals and business people to take mass transit. Stockholm is using road tolls, and many British towns have implemented road calming measures. These measures, also used in Germany, limit vehicle speed to 30 km/h and give the right of way to pedestrians and cyclists.

Bourne, Larry S. "Limits to Urban Growth: Who Benefits? Who Pays? Who Decides? A Commentary on the Current Planning Climate in Canadian Cities." *Urban Forum/Colloque Urbain*, 1,4 (Winter 1975-76). Distinguishes between sprawl (unplanned growth) and well planned, orderly extension of the suburban margin. "Urban growth is exogenously determined—by growth in the national economy, and by broad demographic trends. To attempt to impose limits on such growth, as is so often the case, in splendid isolation, is regressive. It may seriously distort patterns of welfare and the distribution of social opportunities within and between urban areas." Advocates more rational use of existing land, including infill and redevelopment, implementing partly by taxing land according to development potential rather than actual use.

Bowers, Chris. "Transport and the Throwaway Society." *Town and Country Planning*, 59 (June 1990): 167-168. Argues clearly in favour of cycling, walking and other non-polluting transportation. Notes that non-polluting transport is more enjoyable and less expensive than cars.

Britton, Francis E.K., "The Car and the City: The Search for Solutions." In *Standing Conference of Local and Regional Authorities of Europe, Conference on Improving Traffic and Quality of Life in Metropolitan Areas*, Göteborg, Sweden, 12-14 June 1990: Working Documents and Conclusions, Strasbourg: Council of Europe, 1990, p. 33-47. Argues that the proper objective of planners and policy makers "should not be cars or infrastructure, but mobility." Describes a project to establish an international clearinghouse for ideas and initiatives related to cars, mobility and the quality of life in urban places. To find environmentally sound transportation solutions that work socially and technically we are going to have to build in a sophisticated understanding of social organization, behavior, lifestyles and expectations.

Brown, Lester R. and Jodi L. Jacobson, *The Future of Urbanization: Facing the Ecological and Economic Constraints*. Washington, D.C.: Worldwatch Institute, 1987. Overview of the environmental and other challenges of global urbanization. Includes useful general discussions of the history of urbanization, urban energy use, food supply, transportation, sewage and wastewater treatment, and other issues. Many brief examples are given of positive measures. Concludes that laissez-faire economics is the best way to achieve sustainability.

Burlington Community Land Trust. *Community Land Trusts: A Creative Response to Vermont's Affordable Housing Crisis*. Burlington, 1988. To ensure affordable housing Community Land Trusts remove land from the speculative market, permanently. Subsidies are retained and recycled for the benefit of future generations. It is cheaper to rent the land than make mortgage payments on the purchase price (see figures). Perpetual affordability is achieved by returning much of the appreciated value of the property (75 per cent in the case of Burlington) to the Trust. Case studies.

Butler Group (Consultants) Inc. *Land Use Planning Controls*. A Background paper prepared for the Greater Toronto Area Greenlands Strategy. Toronto, 1990. Reviews land use planning controls available and concludes that these can be effective in protecting greenlands. Examines density transfers from donor to receiver sites. Oak Ridges Moraine not protected, Niagara Escarpment and major river valleys generally well protected. Recommends Policy Statement under *Planning Act* for GTA, investigation of Minister's Zoning Order to protect Moraine.

Calthorpe, Peter. "The Urban Context." In Sim Van der Ryn and Peter Calthorpe, eds. *Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns*. San Francisco: Sierra Club, 1986, p. 1-33. An important chapter in an important book. Looks at the history of U.S. cities with an emphasis on grids and other features. Two careful case studies of contemporary evolution: Sacramento and Philadelphia. Sacramento has emphasized infilling, density increases and mixed use. Philadelphia has emphasized renovation of existing structures. Looks closely at the importance of a variety of housing types: for the elderly singles, and families, and for a variety of

income groups. "The health of a community rests on its ability to satisfy divergent needs rather than cater to a select elite" (p. 9).

Canada. Environment Canada. Lands Directorate. *The Impacts on Land Use of CMHC Municipal Infrastructure Assistance, 1961 to 1980.* Working Paper No. 32. Ottawa: 1984. Concludes that government support for servicing (sewage and water trunk sewers, water supply) has influenced patterns of urban development. "Infrastructure construction has potential to consolidate urban development into a compact form."

Canada. Environment Canada. Conservation and Protection Branch. *Urbanization of Rural Land in Canada, 1981-1986.* Ottawa, 1989 (State of the Environment Fact Sheet No. 89-1.) Presents data by province on rural-to-urban land conversion in Canada between 1966 and 1986, with emphasis on recent trends.

Canadian Mortgage and Housing Corporation. *ACT (Affordability and Choice Today): Discussion Paper on Regulation Related to Housing Affordability.* Ottawa, 1989. Examines residential intensification in the Ottawa area, primarily through infilling and house-to-apartment conversion.

Canadian Urban Institute. *Housing Intensification: Policies, Constraints and Challenges.* Toronto, 1990. Background paper for Housing 2 Million: Urban Solutions Charrette, held December 1990. Very useful. Defines intensification. Objectives are social, economic, environmental. Reviews initiatives in Canada and around the world. But, "The containment or consolidation policy outcomes remain to be seen." Examines programmes to support intensification at all levels of government. Bibliography.

Canadian Urban Transit Association. *The Environmental Benefits of Urban Transit.* Toronto, 1990. Summarizes the environmental impact of Canada's automobile-based transportation system, and the comparative advantages offered by public transit. Contains a great deal of up-to-date Canadian data. Includes a series of policy recommendations for fostering improved transit and a more sustainable environment in Canada: municipalities should require high density along present and future transit corridors.

Carver, Humphrey. *Cities in the Suburbs.* Toronto: U of T Press, 1962. The Canadian suburb was not an escape from the city since Canadian cities were never so bad. "A promiscuous use of land is made possible by cars and trucks; the hunt-and-peck form of real estate development is encouraged by a vehicle that can bypass, leap-frog, and skip the intervening spaces to reach the cheaper land." Foresees the evolution of town centres in suburbia with housing "clustered intensively around the focus."

Center for Urban Well-Being. *Making Cities Livable Newsletter,* 1, (April 1988). Includes articles on "Architecture and the Livable City", "A Guide for Establishing Farmers Markets", "A New Vision of the 'City of Man'", "New Approaches to Traffic Planning", and "Scattered Site Infill Housing".

City of Toronto. Board of Health. *Report 13: War on Pollution from Automobiles, Buses and Trucks.* Toronto, 1990. Includes specific recommendations to reduce automobile use, plus some discussion of European car-reduction measures that might complement land-use intensification measures.

City of Toronto. Special Advisory Committee on the Environment. *The Changing Atmosphere: A Call to Action.* Report Number One. Toronto, October 1989. Recommends action to achieve 20 per cent reduction in Toronto's 1988 carbon dioxide emissions by 2005. Some valuable statistics on the relative importance of various CO_2 sources, including the transportation sector.

City of Toronto. *Housing on Toronto's Main Streets.* Toronto, 1989. Examines potential for intensification on 26 miles of main streets within the City. Reports a theoretical potential to increase from less than 20,000 units above stores to almost 100,000 units, with five-storey retail-residential buildings. A doubling is perhaps more realistic.

City of Vancouver. *Clouds of Change,* Final Report of the City of Vancouver Task Force on Atmospheric Change. Vancouver, 1990. Advocates "hardening" the urban fringe. Recommendation 18: "that council direct the City Planning Department to study an ecological incentive program which would implement a floor space incentive system" Recommends low-interest municipal loan programmes to encourage convert-to-rent. See also amended recommendation 19, p. 4, advocating proximity planning to reduce transportation.

City of Vancouver. Planning Department. *New Neighbours: How Vancouver's Single-Family Residents Feel About Higher Density Housing.* Vancouver, June 1986. "Of neighbours who were interviewed, not one felt that the project had contributed to overcrowding of community facilities." Most intensification project residents come from the neighbourhood, yet neighbours don't know that and are still concerned. A main concern appears to be the inappropriateness of such a project in a single-family area.

Conservation Council of Ontario. *An Environmental Strategy for Ontario: Draft for Public Review.* Toronto, 1990. Includes issue areas such as land-use, energy, and agriculture. Outlines objectives and strategies to achieve them.

Deelstra, Tjeer. "Human Settlement and Sustainable Development in Western Europe." In *Human Settlements and Sustainable Development.* University of Toronto, Centre for Urban and Community Studies. Symposium held June 21-23, 1990. Reviews initiatives in Western European cities regarding construction, intensification, naturalized spaces, transportation, and design. Filled with useful examples. Informed by an intelligent appreciation of the concept of sustainable development.

Dickinson, Terence. "Bring Back the Night: The Unbearable Beingness of Light." *Harrowsmith,* (November-December 1988): 37-43. Opposition to light pollution. "Until recently, little thought has been given to designing task-efficient outdoor lighting ... Now somebody has to say 'Let's stop and think about this.'" Glare should be reflected down.

Flanagan, Barbara. "A Massachusetts Mall is Just Disappeared." *New York Times,* (March 14, 1991): B5. An excellent case study of suburban retrofit where a previously low-density area with an anonymous shopping mall was completely razed to "create" a downtown shopping area with store-top housing, churches and libraries and a wide mix of housing types in the immediate vicinity. The project, called Mashpee Commons, is in Mashpee, Massachusetts. Elizabeth Plater-Zyberk, the project architect, has founded the first American graduate program in architecture that "treats suburbia as a serious design problem." Advantages of this kind of redevelopment are discussed in social and community terms rather than environmental or energy terms. Some transit opportunities and problems are mentioned.

Goldstein, David B., et al. *Efficient Cars in Efficient Cities,* Natural Resources Defense Council/Sierra Club: Testimony for the Conservation Report Hearing on Transportation Issues, State of California Energy Resources Conservation and Development Commission, April 23, 1990. Passenger transportation energy use can be reduced in two ways: by making cars more efficient, and by making urban structures more efficient. Argues that both approaches are feasible, and presents evidence showing that each could realistically produce a 30 per cent or greater reduction in transportation energy consumption over the next 30 years. The urban efficiency argument is largely based on the findings of John Holtzclaw, *Explaining Urban Density and Transit Impacts on Auto Use,* cited below.

Goodman, Paul and Percival Goodman. *Communitas: Means of Livelihood and Ways of Life.* New York: Vintage, 1960. Second edition. History of town and regional planning ideas from a civilized anarchist perspective.

Gordon, David, ed., *Green Cities: Ecologically Sound Approaches to Urban Space.* Montreal: Black Rose Books, 1990. Important guidance for maintaining and enhancing natural values during urban intensification. Canadian, but with examples from the United States, England, the Netherlands, and India. Emphasizes conceptual issues such as integrating natural urban space with other recreational as well as non-recreational (residential, industrial) land-uses.

Gossop, Chris. "Choose It Or Lose It—Lessons From the Netherlands NEPP." *Town and Country Planning,* 59 (June 1990): 179-181. Reviews the Dutch National Environmental Policy Plan, analogous to the Canadian Green Plan, but with real targets, timetables and strategies. The Plan addresses ways of achieving significant reductions in automobile use. The article observes that a considerable and consistent political will is necessary to counter the strong automobile infrastructure lobby.

Hamilton, Dale, ed. *Housing in the Countryside.* Guelph: University of Guelph. School of Landscape Architecture, in preparation. Includes two design examples of intensified, clustered alternatives to severance and rural estate lot housing.

Hawthorne, Wendy. *Why Ontarians Walk, Why Ontarians Don't Walk More*, Toronto: Energy Probe, June 1989. Documents the health, environmental and economic advantages of walking as a mode of transportation. Sets out the results of a survey conducted in Toronto, Ottawa-Carleton and Thunder Bay on why people do or do not walk to work, to do errands, or for leisure. Describes the specific experiences and facilities people do and don't like when they walk.

Hendler, Bruce. *Caring for the Land: Environmental Principles for Site Design and Review*. Chicago: American Society of Planning Officials, 1977. Report 328, Planning Advisory Services. Lots of drawings to illustrate good and bad site site. Covers natural resources inventory, ecologically sensitive areas, natural resources, scientific resources, visual resources. Topography, soils, water, vegetation, lotting arrangements (e.g. clustering).

Hiemstra, Hal and Nancy Bushing, eds. *Plowing the Urban Fringe: An Assessment of Alternative Approaches to Farmland Preservation*. Monograph 88-2. Florida Atlantic University Center for Environmental and Urban Problems, 1989. Reports in considerable detail on eight of the most successful state and local farmland protection programs in the United States. Within each case study, a variety of *working* agricultural land protection strategies are discussed—ranging from development rights acquisition programs to working farm tax abatement or reimbursement systems to state-wide zoning change restriction legislation, i.e. exclusive agricultural zoning ordinances. Some measures could be adopted in Ontario to complement urban intensification.

Holtzclaw, John. *Explaining Urban Density and Transit Impacts on Auto Use*. Natural Resources Defense Council / Sierra Club: Study Presented to the State of California Energy Resources Conservation and Development Commission, January 15, 1991. Compares vehicle miles travelled (VMT) per capita and per household for five communities in the San Francisco region with widely ranging population and commercial densities and access to transit service. Reviews earlier data on this subject from Chicago, New York, Great Britain, Toronto and elsewhere. The results show a consistent pattern: Doubling residential or population density reduces the annual auto mileage per capita or per household by 20 to 30 percent. Recommends improved transit, mixed-use zoning and higher densities in urban centres and along transit corridors.

Hough, Michael. *City Form and Natural Process* London: Routledge, 1989. Emphasizes the need to integrate urban form with the natural processes. Site-specific. Very useful for everything from design and planning considerations for urban greening to the choice of plant species to be used in projects. Case studies and examples range from urban parks to university campuses to former industrial sites.

——. *Out of Place—Restoring Identity to the Regional Landscape*. New Haven: Yale University Press, 1990. Contrasts utopia ("no place") and eutopia ("good place"). Study should help planners to ensure that intensification projects have designed into them the capacity for a sense of place, a sense of community, a sense of belonging. "Creating a sense of place involves a conscious decision to do so." Examines a variety of human-modified landscapes, urban, sub-urban and rural. Probes what works and why. Emphasizes *restoration* of existing structure and landscape rather than building from scratch.

Hughes, Peter. "How Green is My Maestro." *Town and Country Planning*, 50, 1 (January 1990): 22-25. Reviews the relationship beween automobile use and global warming. Presents recent British data on the energy efficiency of major urban travel modes; relationship between land use, transportation and energy use; policy suggestions.

Hulchanski, David J. *Making Better Use of the Existing Housing Stock: A Literature Review*. Study for the Ministry of Municipal Affairs and Housing and Association of Municipalities of Ontario. Toronto: Queen's Printer, 1982. Intensification is not welcomed by the public as a priority means of meeting housing needs. Redevelopment to high-rises is especially disliked. People like the conversion option in principle better than they like it in their neighborhoods. People who live in small-lot subdivisions (zero lot-line) like them. Deconversion (multiple to single units) a is a problem in Toronto and Ottawa.

IBI Group. *Greater Toronto Area Urban Structure Concepts Report*. Toronto: Greater Toronto Coordinating Committee, 1990. A summary of eight detailed background reports (see below). Compares three options for the future shape of the Greater Toronto Area: spread, central, and nodal. Favours central and nodal forms over sprawl.

Examines the impacts on human and hard services, environment management, economic development, transportation, adjacent lands, and capital and operating costs. Comprehensive.

——. *Transportation. Background Report No. 3. Greater Toronto Area Urban Structure Concepts Study.* Toronto: Greater Toronto Coordinating Committee, 1990. Spread and nodal have more GO transit. Also compares new rapid transit, rail, frequencies of service. "Road congestion more likely" with most intensified option. Estimates air pollution impacts.

——. *Greening/Environment. Background Report No. 5. Greater Toronto Area Urban Structure Concepts Study.* Toronto: Greater Toronto Coordinating Committee, 1990. Compares the three "concepts" for the GTA on the basis of land consumption, greenlands, agricultural capability, forest resources, mineral resources, passive open space, contaminated soil, water quality, energy consumption, air quality. All on the "macro" level. Lots of numbers, tables, maps. Concentration involves redevelopment, which "provides potential for retrofitting such areas to improve storm water drainage quality."

Kanter, Ron. *Space for All: Options for a Greater Toronto Area Greenlands Strategy.* Toronto: Queen's Printer for Ontario, 1990. Recommends that the province introduce a Greater Toronto Area Greenlands policy statement under section 3 of the *Planning Act* to limit uses incompatible with greenlands. Valleys and watercourses should be left in as natural a state as possible, with buffer zones of at least 10 to 15 metres. "[T]he policy statement would stress the need for more intensive and clustered forms of development, thereby maximizing the lands available for greenlands and other uses." Recommended declaration of provincial interest in the Moraine. Regions should identify "greenlands envelopes". Provincially funded land acquisition. Review *Trees Act*.

Keall, M.J., ed. *Development at the Edge—A Symposium Investigating the Integration of Conservation Strategies and Planning and Development on the Fringe of Cities.* Toronto: Urban Studies Program, York University, 1986. Various perspectives on urban fringe developments, particularly municipal, environmental, agricultural presentation and landscape design perspectives. Short on details or strategies. Philosophical rather than practical.

Kielbaso, J. James. "Trends and Issues in City Forests." *Journal of Arboriculture,* 16, 3 (March 1990): 69-76. Surveys municipal tree-planting and maintenance in the U.S.. Anticipates support for tree planting to sequester atmospheric carbon dioxide, and to offset the urban heat island effect.

Knaap, Gerrit. "State Land Use Planning and Inclusionary Zoning: Evidence from Oregon." *JPER,* 10, 1: 39-46. Argues for inclusionary zoning (mixed uses) vs. exclusionary zoning. Local residents favour exclusionary approach. Developers and environmentalists form state-wide alliance for inclusionary zoning to achieve housing that is more compact, varied in form, and more affordable to low-income residents.

Lang, Reg and Audrey Armour. *Planning Land to Conserve Energy: 40 Case Studies from Canada and the United States.* Ottawa: Environment Canada, Lands Directorate, 1982. Land Use in Canada Series No. 25. Case studies. Six strategic issues for planners: how to get started, what to do first, demand vs supply focus, degree of emphasis on land-use planning, overcoming institutional barriers, generating public and political support.

Langdon, Philip. "A Good Place to Live." *The Atlantic Monthly,* (March 1988): 39-60. Describes rise of neo-traditionalism in American town planning, featuring the work of Andres Duany and Elizabeth Plater-Zyberk. In Seaside, size of porches and distance from street dictated in an (apparently unsuccessful) attempt to revitalize front porch life. Straight as opposed to curvilinear streets favoured to help create a "public room". Order, dignity. Walkability. Sensitivity to vernacular, not only in architecture, but also in urban form and design. Fix acres of parking lots partly by partitioning them with sidewalks. Favours "informal socializing" vs privatized enclaves.

Lemire, Robert A. *Creative Land Development: Bridge to the Future.* Boston: Houghton Mifflin, 1979. How to resist the ex-urban trend. Mostly about direct land purchases by municipalities as a defensive strategy, with controlled limited development to raise cash.

Lennard, Suzanne H. Crowhurst and Henry L. Lennard. *Livable Cities. People and Places: Social and Design Principles for the Future of the City* Southampton, N.Y.: Gondolier, 1987. A celebration of the livable city. Addresses design principles such as traffic free zones (pedestrian

zones), public squares, mixed uses, new concepts in traffic planning.

Lewinburg, Frank R. *Neighbours In Your Neighbourhood*. Toronto: Ministry of Housing, 1987. Stats on population and household growth, persons per household, urbanization. Shrinking populations mean shrinking tax base. Potential for conversions. Advantages of "neighbourhood intensification". Study identified causes of resistance to neighbourhood change. Internal conversions created the least concern. Homeowners fear renters. Tenants are profiled, demystified. Concludes that a lower parking standard for conversion would have little impact on the parking problem.

Lorimer, James. *The Developers*. Toronto: Lorimer, 1978. Invaluable history and political economy of post-war development of the "corporate city", including its suburban forms. Evolution of the land development corporation and the development industry. Concludes that land should be viewed as a natural resource, and that profits based strictly on land ownership should be taxed away.

Lyman, Francesca. "Rethinking Our Transportation Future." *E Magazine*, 1 (September-October, 1990): 34-41. The origin and development of the "car culture" in the United States, its environmental and social impacts, and opportunities for progress in mass transit and non-motorized transit in the future. Good treatment of subsidies and incentives to automobile use. Proposes reform. In California, cars are subsidized at least $2,400 (US) per year with road costs, policing, and free parking. Meanwhile, employers can write off $200 per month in free parking for each employee, but only $15 in transit fees. Notes the lack of "gas sipper" rebates to match gas guzzler taxes. Interesting facts. Commuting to and from work now accounts for 38 per cent of all automobile trips. Approximately 40 per cent of all policing expenses relate to traffic control, car accidents, and car theft. In Delft, Holland, where more than 40 per cent of travel is by bicycle, it is impossible to drive across city in a car because of cul-de-sac and neighborhood urban design. In Singapore, cars carrying less than four passengers are charged a special "congestion fee" at toll booths during rush hour.

Maynes, Clifford, ed. *Sustainability As If We Mean It*. Guelph: Ontario Environment Network, 1991. A comprehensive action agenda for achieving sustainability in Ontario, supported by 85 citizens groups and environmental organizations. Issue areas include Urbanization and Farmland, and Transportation. Also proposes measures to improve the decision-making process and empower citizens to protect the environment, e.g., consultation, environmental bill of rights, right to refuse to pollute.

McCamant, Kathryn and Charles Durrett. *Cohousing: A Contemporary Approach to Housing Ourselves*. Berkeley: Habitat Press/Ten Speed Press, 1988. Outlines a form of housing developed in Denmark "that combines the autonomy of private dwellings with the advantages of community living. Each household has a private residence but also shares extensive common facilities with the larger group, such as a kitchen and dining hall, children's playrooms, workshops, guest rooms, and laundry facilities" (p. 11). Common characteristics of "cohousing" projects are participatory process, intentional neighbourhood design, extensive common facilities, and complete resident management.

McLaren, Duncan. "Higher Densities—A Revival Path for Cities." *Town and Country Planning*, 59, 12 (December 1990): 346-7. A summary of the convergence of urban renewal needs and environmental management needs (particularly CO2 reduction) through urban intensification and higher residential densities. Argues that cities reclaimed from automobile domination with be *both* economically *and* environmentally improved.

Metropolitan Toronto. *Introducing Change in Metro's Communities. Housing Intensification Discussion Paper* #2. Toronto, 1989. Intensification is needed to provide housing for young people and seniors, supply greater variety of prices and sizes. Objective: "that fewer families will be forced to leave the Metropolitan Toronto area in search of affordable housing." People are concerned about absentee landlords, but present legislation does not permit municipalities to require owner-occupancy as a condition of approval to create an accessory apartment. Enforcement of minimum standards by-laws on a complaint basis inadequate. "The average number of vehicles per person increased approxiately 60.7 per cent from .28 in 1961 to .45 in 1986." Various means of providing more parking. An estimated 10 to 20 per cent of ground-related housing stock in Metro contains illegal units. These infractions should be prosecuted on health and safety grounds, but not

on zoning grounds alone. An avalanche of conversions is unlikely.

——.*Broad Population Trends. Housing Intensification Discussion Paper #1*. Toronto, 1989. Housing demand bulge due to baby boom. In City of Toronto, 1976 to 1985, 17,000 rental units were lost as a result of deconversion (condos, multi-units to single). Metro committed to 2.5 million by 2011; that's 300,000 new units at 2.4 persons per hectare.

——. *The GTA: Concepts for the Future*. Toronto, 1990. A key report, more sophisticated than the IBI urban structures concept reports. Appears to be grounded in reality rather than concepts. Good historical background and factual overview. Outlines principles of sustainable land-use, planning alternatives with respect to natural environment, transportation, employment, and housing. Outlines five alternative growth patterns (as opposed to the IBI's three) and concludes in favour the "Reinvestment Centres alternative", which features a combination of some intensification in built-up areas and new nodal development. Favours implementation through a provincial-municipal partnership. Provincial policy statements are needed on environmentally significant features (e.g. Oak Ridges Moraine) and a policy statement is needed approving the major elements of the GTA concept plan prepared by a revamped (democratic) Greater Toronto Coordinating Committee.

—— . *Housing Intensification Policy Report No. 2*. Prepared by the Policy Development Division of the Metropolitan Toronto Planning Department. Toronto, 1989. Target Metro population 2.5 million over 20 years. 300,000 units needed; 209,000 units would only maintain current population at 2.2 million. That's 14,000 units/year over 21 years, vs. previous 10-year average of 9,960 units. Area municipalities are nervous about pre-zoning for intensification: it will create instability, uncertainty. City of Toronto opposes softer *Landlord and Tenant Act* to encourage accessory apartments—recommends assistance to small landlords instead. Implementation: set targets in OPs, provide services, identify surplus Metro lands and potential for redevelopment along arterials. Endorses medium density, not high-rises. "Due to the shortage of available land in Metropolitan Toronto, it is anticipated that the majority of the required housing units will be created through the redevelopment process" (p. 33).

Metropolitan Toronto Planning Department. Policy Development Division *Community Conflict Resolution Centres: A Resource for Neighbourhood Planners*. Housing Intensification Discussion Paper 3. Toronto, 1989. Introduces notion of conflict resolution service to mediate between parties in a planning dispute. Hearings are held with volunteer panel members from the local community. The final outcome is a signed statement of agreement. Effective between neighbours and landlord-tenant disputes. This document is brief, with little detail. No case studies. Two Ontario contacts listed.

Michelson, William. "Density and Livability—People and Place." Human Settlements Issues: Occasional Paper 30. Centre for Human Settlements, 1984. Problems in Sweden with high density new communities—vacancy, crime, etc. (However, Michelson's model in Toronto is St. James Town—a forest of high-rises, and not at all what is usually meant these days by land-use intensification.) Density is persons per hectare, but also a subjective feeling of crowding. Importance of effective soundproofing. Mediating factors: per capita access to resources; crime-preventive site planning and architecture (view of who belongs and who doesn't, avoid transients); diversity at appropriate levels ("sheer heterogeneity and indiscriminate mixing" causes strain); compensation for vulnerability (appropriate infrastructure); fostering the feeling of control (idea for designer/user co-operation: a full-scale (?) environmental laboratory in which people can build prototypes of environments with reusable, modular materials). Example of Swedish project where residents accepted smaller unit size in exchange for joint facilities (day care, recreational).

Newman, Peter and Jeffrey Kenworthy. *Cities and Automobile Dependence: An International Sourcebook*. Hants, England: Gower Publishing, 1989. Comparative data from 32 major world cities on population, area, density, location of jobs, parking, roads, car ownership, gas consumption, car and transit use, vehicle occupancy, traffic speed and other characteristics. Includes Toronto, eleven cities in the United States, thirteen in Europe and three westernized cities in Asia. Concludes that cities wanting to reduce their gasoline and car dependence should increase their land use intensity, orient their transportation infrastructure more toward non-auto modes of travel, restrain high-speed traffic flow, centralize more jobs and housing, and increase their public

transit performance. 200 pages of data and a highly detailed analysis.

Ontario. Ministry of Energy. *Residential Energy Trends*. Toronto: Queen's Printer, 1986. Some useful numbers.

——— . *Perspectives on Access to Sunlight*. Toronto: Queeen's Printer, 1980. Covers various solar energy protection mechanisms, including restrictive covenants, solar zoning, etc.

———. *Landscape Planning for Energy Efficiency*. Toronto: Queen's Printer, 1982. A detailed source for energy-related site-planning, including the use of vegetation. Also includes a chapter on Integrated Methods and Techniques: site analysis, site planning and desing, groups of buildings, etc.

. *Energy and Rural Land Use Planning Ontario*. Toronto: Queen's Printer, 1982. "The addition, or revitalization, of a centrally-located hamlet was found to contribute to a decline in transportation-related energy consumption."

——— . Economics and Forecasts Section. *Ontario's Energy-Related Carbon Dioxide Emissions, 1988 and 2000*. Toronto, February 1990. Background paper for a symposium on global warming.

Ontario. Ministry of Housing. *Accessory Apartments: Property Values*. Toronto: Queen's Printer, 1988. Pamphlet identifies social and private benefits of creating accessory apartments. Graph shows growth in "potential underutilized housing stock". Cites a study that found no evidence accessory apartments have a negative effect on adjacent houses. "Generally, neighborhood fears about the potentially negative impact of conversion activities are unfounded in reality." The study: Ekos Research Associates, Inc. *The Impact of Conversions on Neighborhoods: Property Values and Perceptions*.

——— . *Policy Statement: Land Use Planning for Housing*. Toronto: Queen's Printer, 1989. A statement of Ontario government policy issued under Section 3 of the *Planning Act*. See Section 5 on residential intensification. Also, Implementation, p. 10-11, which requires OP and zoning by-law provisions to implement this policy statement by 1 August 1991 in key areas like the GTA.

Ontario. Ministry of Municipal Affairs. *Home Occupations*. Prepared by Research and Special Projects Branch. Toronto, 1987. Covers regulatory options and planning guidelines.

Ontario. Ministry of Municipal Affairs and Housing. *Urban Development Standards: A Review*. Toronto: Queen's Printer, 1982. Potential for money and energy savings through "reduced standards" for new residential subdivisions, i.e. mostly higher densities.

Ontario. Ministry of Municipal Affairs and Housing, and the Association of Municipalities of Ontario. *Study of Residential Intensification and Rental Housing Conservation. Part 1: Detailed Summary of Findings and Recommendations*. Toronto: Queen's Printer, 1983. Summary of a multi-part study. This report appear to have prompted the intensification statement in the province's land use planning for housing policy and other intensification measures, such as promotion of "accessary apartments". Conclusions: Over half a million owner-occupied single family dwellings in Ontario "would appear to have sufficient excess space to accommodate at least one additional person or household." This housing would be cheap, an attractive investment, and "unlikely to cost municipalities any more than new suburban development even given the extensive grants and levies that municipalities currently receive to offset the costs of suburban development." To ensure neighborhood acceptance "it is essential to ensure that the most critical physical aspects of change will be adequately controlled." Absentee landlords and young single tenants not favoured. Identifies policy initiatives.

Ontario. Ministry of Transportation and Communications. Provincial Highways Planning Committee, Highway Program Development Branch. *Future Perspective: Provincial Highways, 1981-2001*. Outlines the assumptions behind highway planning and major plans. Points out that transportation investments are used to stimulate development (i.e., urbanization).

Ontario Round Table on Environment and Economy. *Challenge Paper*. Toronto, 1990. Intended to initiate debate and public input to assist the Round Table in preparing a sustainable development strategy for the province. Favours compact urban form over sprawl. Also looks at some natural area and environmental management implications of urban form. The Round Table is a multi-sectoral body with representation from business and industry, labour, environmentalists, farmers, and others.

Owens, Susan. *Energy, Planning and Urban Form.* London: Pion, 1986. A summary work that brings together much of the available material, both practical and theoretical, on the relationship between energy and land use. Makes the case for building energy considerations into urban planning, reviews the current situation, offers many specific policy suggestions, and then presents a number of case studies.

——. "The Urban Future: Does Energy Really Matter?" In Dean Hawkes, *et al.*, eds. *Energy and Urban Built Form.* London: Butterworth, 1987, pp. 169-185. Points out how little has been done in terms of urban energy efficiency since the oil shocks of the early 1970s. Suggests that energy price increases, in and of themselves, are unlikely to lead to significant changes in urban form as there are so many ways in which efficiency can be increased within present patterns of development. The characteristics of genuinely energy-efficient development are examined, and the author concludes by recommending more active and interventionist government policy in this area.

Paehlke, Robert. *Environmentalism and the Future of Progressive Politics.* New Haven: Yale, 1989. Includes an extensive discussion of the evolution of environmentalism as a socio-political movement, as well as the relationship between conservation and environmentalism. Environmentalism is considerably more urban in perspective and should be moreso.

Pendakur, V. Setty. "Taming the Automobile: Lessons from Singapore." *Plan Canada*, 27 (November 1987): 208-214. Even as Singapore's per capita gross domestic product almost tripled between 1975 and 1985, car ownership increased only 32 per cent. How did they do it? Primarily increased vehicle taxes, increased parking fees, an Area Licensing System (ALS) and upgraded public transit. The ALS is intended to keep low-occupancy private vehicles out of the CBD duirng peak hours. It is supplementary to the already-costly private vehicle licence.

Peterborough Task Force on Sustainable Development. *Report.* Peterborough, 1990. Ideas for implementing sustainability in the Peterborough area in a variety of sectors. Practical orientation: what to do, how, who.

Polanyi, Margaret. "Double pace of core housing, planners urge." *Globe and Mail* March 5, 1991, A7. City of Toronto staff working on proposal to double the rate of downtown housing construction "on a belief that encouraging people to live and work downtown reduces long-distance commuting, checks urban sprawl and makes for a vibrant, safe city." Target: 45,000 new housing units in Toronto by June 2001, at least half social housing. In commercial sector, reduce bonusing and expand use of "exactions" to help pay for public facilities. Require developers to build social housing into their developments—not off-site or cash-in-lieu. New system of calculating residential density: instead of controlling number of units, which can promote large units, zoning should control gross floor area. See also: "Quality of life in the city at stake in next blueprint." Ten-year target of 40,000 new units in 1976 plan not met. Net loss of affordable housing units due to demolition of buildings and conversion into condos.

Preservation of Agricultural Lands Society. *Land at Risk.* Summary of a conference held April 7, 1990 at Brock University, St. Catharines, Ontario. Discusses loss of Ontario farmland to urbanization (Elbert van Donkersgoed: 85 per cent of houses are going onto foodland, and of those 35 per cent are on class 1 agricultural land). Key contributor was William Powell, director of the Foodland Preservation Programmes for Carroll County, Maryland, where the purchase of "development rights" from farmers is being used to protect land for permanent agricultural use.

Preston, Barbara. "Home Zones—Child's Play for Inner Cities." *Town and Country Planning*, 59, 4 (April 1990): 116-117. Poor children have no alternative to playing on the streets, hence a high level of child pedestrian accidents. Advocates restrictions on cars in residential areas called "home zones".

Reid, Ron and Stewart Hilts. *Land Stewardship Options.* Background paper prepared for the Greater Toronto Area Greenlands Strategy. Toronto: Queen's Printer for Ontario, 1990. Reviews land stewardship options (for private lands) ranging from education and voluntary agreements to conservation easements and trusts. Recommends legislation so that conservation authorities, municipalities, and non-profit conservation groups (trusts and foundations) can negotiate and hold statutory conservation easements. Recommends a GTA Countryside Trust, an Oak Ridges Trust, series of community-based land trusts.

Renner, Michael. *Rethinking the Role of the Automobile.* Worldwatch Paper 84. Worldwatch Institute, 1988. Discusses energy consumption and other environmental impacts in a global context, concluding that efficiency increases and emissions controls cannot solve the problems alone: we need to reshape transportation. Addresses the "symbiotic relationship" between land use and transportation and advocates "neo-traditionalism" in planning, i.e. land-use intensification of suburbs.

Roberts, James S. "Energy and Land Use: Analysis of Alternative Development Patterns." *Environmental Comment,* (September 1975): 2-11. Anticipates the current Ontario discussion of urban form and energy use by about 15 years.

Rybczynski, Witold. "Living Smaller." *Atlantic Monthly,* February 1991. McGill University professor who designed the Grow Home traces history of home size (bulking out), family size, home ownership, land-use densities. Houses have become warehouses for consumer toys. Tribute to the row house. Success of the mobile home shows acceptance of smaller homes. "The institution of no-growth legislation by many towns exacerbates the housing problem, because it places quotas on the number of new houses that can be built each year and effectively guarantees that developers will build only large, luxurious houses."

Sai-Chew, Dick, et al. *Architectural Energy Conservation Technologies Study.* Toronto: Ontario Hydro, 1988. Looks at energy conserving design features for commercial and industrial buildings, ranging from low emissivity windows to earth sheltering to "daylighting" to double building envelopes. Assesses energy savings potential and cost. According to Hydro, only "daylighting" (designing buildings so that they need the least possible artificial light) produces a significant return on investment in less than five years. Most options have about a 15- to 20-year payback period, based on 1988 gas, oil and electricity prices. [Note: Hydro's nuclear plants are amortized over 40 years.]

Sewell, John. Four articles on the origins of the suburbs, failings, and alternatives. In Lorimer, James and Evelyn Ross, ed. *The Second City Book,* Toronto: Lorimer, 1977. Also, "Old and New City", *City Magazine,* Winter 1986. The new city (automobile suburb) is characterized by low density, switch from streetcar to automobile, homogeneity and segregation of uses, lack of public spaces. Tory (old city) vs liberal (new city) values.

Solway, Jeff. *Reflections on Sustainable Planning—The Implications of Sustainable Development for Planning and the Canadian Institute of Planners.* Ottawa: 1990. A broad discussion of planning and sustainable development ranging from principles, to tools, to the role of the Canadian Institute of Planners.

Stilgoe, John R. ed. *Borderland: Origins of the American Suburb.* New Haven: Yale University Press, 1989. Contends that U.S. suburbs reflect white middle class desire to escape dangers and disorder of urban cores while still being close enough to enjoy urban-scale amenities. Suburbs—a form of gentrified wilderness—allow residents to avoid the "hardships", challenges, and opportunities of urban and rural life.

Stokes, Bruce. "Recycled Housing." *Environment.* 21 (January-February, 1979), 6-14. Written as the Yuppie generation was emerging and urban gentrification was gaining momentum in cities like New York, Baltimore and Toronto. Seen as a partial solution to the need for urban renewal. Renovating ("recycling") a home one-third to one-half the cost of a new dwelling. "Older buildings, which were often designed to be compatible with their environment and to be naturally heated and cooled, can be rehabilitated to rely on many of these same solar properties, thus reducing their dependence on non-renewable fuels" (p. 12).

Taylor, M.A.P. and P.W. Newton. "Urban Design and Revitalization—An Australian Perspective." *Urban Ecology,* 9 (1985): 1-23. Highlights redesign of residential areas and streetscapes (as wealthier people and young families move in), revitalizing city cores (boutiques, cafés, and pedestrianization), building and site rehabilitation, and heritage preservation as an alternative to wholesale redevelopment.

Tibbalds, Francis. "Future of Cities—(Another) 10 Commandments." *Town and Country Planning,* 59 (December 1990): 347. A concise summary of basic concepts for future urban development, including mixed-use zoning, public consultation, and professional development. Urban planning needs rethinking and redefinition to respond to daunting urban and environmental problems.

Toronto City Cycling Committee. *Bike to the Future: A Vision for a Bicycle-Friendly Toronto.* Toronto, 1990. A series of recommendations for encouraging and improving cycling in the Toronto area, most of which are applicable to other cities as well.

Urban Land Institute. *Project Reference File,* (October-December 1986). Washington D.C. Article on Seaside, Walton County, Florida. Community designed by Andres Duany and Elizabeth Plater-Zyberk. Features include through-block pedestrian connections. Urban code developed by planners sets out eight categories of building types describing yards, porches, outbuildings, parking, heights. The code permits diversity within limits, creating a unified feel.

Weir, Colleen. "A Voice for Balance." *City Magazine,* 11 (Summer 1989): 7-8. Women Plan Toronto promotes women's concerns in city planning, particularly with respect to transportation, safety, and poverty. Working together with other advocacy groups, WPT produced recommendations for the Toronto Transit Commission and a variety of social service agencies. As a "voice of balance", WPT seeks to place social and gender concerns on the transit planning agenda.

Weniger, Jane M. "Providing Affordable Housing on Contaminated Land in Ontario." *Canadian Housing: Innovative Family Housing,* 7 (Summer 1990): 23-31. Reviews several projects that seek to restore contaminated industrial lands as housing sites. Cases include Ataratiri, where more than 5,000 housing units will be built on a site in downtown Toronto that had been in industrial use for more than a century. The site is seriously contaminated with PAH and nearly 480,000 m3 of soil does not meet residential land-use guidelines. Clean-up cost is estimated at $2.3 million. Other examples selected are in Brantford, the City of York, and elsewhere in Toronto.

Willson, Richard W. and Donald C. Shoup. "Parking Subsidies and Travel Choices: Assessing the Evidence," *Transportation: An International Journal Devoted to the Improvement of Transportation Planning and Practice,* 17, 2 (1990): 141-157. Review of the research on impact of free parking provided by employers. A strong effect: 19 to 81 per cent fewer employees drive alone to work when required to pay for their own parking. 90 per cent of Americans who drive to work currently have employer-paid parking.

Yeates, Maurice. *Land in Canada's Urban Heartland.* Environment Canada. Lands Directorate. Ottawa: Queen's Printer, 1985. Historical overview and projection of growth in the Windsor-Quebec City "macro-urban region". Outlines where the growth will occur and its effect on rural land, including farmland. The land consumption rate (hectares per 1,000 people) in the "heartland" is still increasing, compounding the effect of population increases.